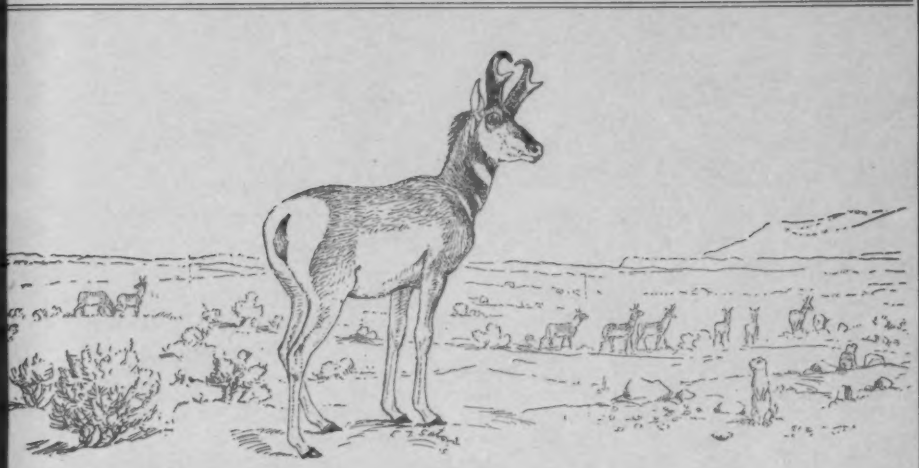
Vol. 2 NOVEMBER, 1921 No. 4

JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists



CONTENTS

	PAGE
On the Habits of Trichosurus vulpecula.....*Frederic Wood Jones*	187
The Occurrence of a Sternal Gland in Orang-utan.....*Adolph H. Schultz*	194
Some Observations on Beaver Culture with Reference to the National Forests *Smith Riley*	197
A Tree-climbing Woodchuck .....*Harold St. John*	207
On Three New Mammals from Japan.....*Nagamichi Kuroda*	208
A New Pinniped from the Upper Pliocene of California.....*Remington Kellogg*	212
A Review of Some Recent Work on the Mammalian Reproductive Cycle *George W. Corner*	227
Two New Rodents from Oregon and Nevada.....*E. A. Goldman*	232
General Notes.....	234

A Fox Associating with Mountain Sheep on the Kenai Peninsula, Alaska, *C. Sheldon;* A Wolverine in a Tree, *N. A. Wood;* A Mongoose in Kentucky, *H. H. T. Jackson;* Pribilof Fur Seal on the Oregon Coast, *S. G. Jewett;* Elephant Seals off the Coast of California, *J. Rowley;* Muskrats in Central Europe, *T. G. Ahrens;* Malformed Hind Foot of the Common House Mouse, *J. D. Soper;* Notes on Napæozapus, *W. E. Saunders;* An Inquisitive Porcupine, *H. H. T. Jackson;* Graysquirrels and Nuts, *E. T. Seton;* Former Range of Mountain Sheep in Northern California, *C. H. Merriam;* Two Mammals New for Ohio, *W. F. Henninger;* Wild Life and the Motor Car, *E. T. Seton* .

Recent Literature.....	240
Index.....	249

PUBLISHED AT
MOUNT ROYAL AND GUILFORD AVENUES
BALTIMORE, MARYLAND

WILLIAMS & WILKINS COMPANY
BALTIMORE, U. S. A.

Entered as second-class matter, November 22, 1919, at the Postoffice, Baltimore, Md., under the Act of March 3, 1879.

The American Society of Mammalogists

Founded April 3, 1919
Incorporated April 29, 1920

E. W. Nelson, *President*
Wilfred H. Osgood; Gerrit S. Miller, Jr., *Vice-Presidents*
H. H. Lane, *Recording Secretary*
Hartley H. T. Jackson, *Corresponding Secretary*
Arthur J. Poole, *Treasurer*
N. Hollister, *Editor*

Additional Directors

1920–1922	1921–1923
T. S. Palmer	Glover M. Allen
Rudolph M. Anderson	Witmer Stone
M. W. Lyon, Jr.	Joseph Grinnell
W. D. Matthew	John C. Merriam
Edward A. Preble	H. E. Anthony

Standing Committees

Publications: N. Hollister, *Chairman.* Gerrit S. Miller, Jr., Edward A. Preble, Hartley H. T. Jackson, William H. Cheesman.

Life Histories of Mammals: Chas. C. Adams, *Chairman.* Rudolph M. Anderson, Vernon Bailey, Harold C. Bryant, Lee R. Dice, Hartley H. T. Jackson, T. S. Palmer, Ernest Thompson Seton, Walter P. Taylor, Herbert Lang.

Study of Game Mammals: Charles Sheldon, *Chairman.* George Bird Grinnell, George Shiras, 3rd.

Anatomy and Phylogeny: Adolph H. Schultz, *Chairman.* John C. Merriam, H. H. Donaldson, W. K. Gregory, J. W. Gidley.

Bibliography: T. S. Palmer, *Chairman.* Wilfred H. Osgood, Hartley H. T. Jackson.

Conservation: Wilfred H. Osgood, *Chairman.* E. W. Nelson, Jonathan Dwight.

Marine Mammals: E. W. Nelson, *Chairman.* Gerrit S. Miller, Jr., T. S. Palmer, Barton W. Evermann, Robert Cushman Murphy.

Economic Mammalogy: A. K. Fisher, *Chairman.* W. B. Bell, Harold C. Bryant.

The Journal of Mammalogy

Subscription rates, $3.50 per year; single numbers $1.00 each. Sent free to all members of the American Society of Mammalogists not in arrears for dues.

Manuscripts for publication, books and papers for notice and review, etc., should be sent to the Editor, N. Hollister, National Zoological Park, Washington, D. C.

Subscriptions, changes of addresses, requests for missing numbers, applications for advertising rates, etc., should be sent to the Corresponding Secretary, Dr. Hartley H. T. Jackson, Biological Survey, Washington, D. C.

JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists

VOL. 2 NOVEMBER, 1921 No. 4

ON THE HABITS OF TRICHOSURUS VULPECULA

BY FREDERIC WOOD JONES

[*Plate 13*]

There are but few Australian marsupials to which the term common or abundant can properly be applied today. It is difficult for any mammalogist, who has only a text book knowledge of the Australian marsupial fauna, to realize how rapidly are the closing scenes of extermination being enacted. More certainly, more swiftly, and withal more silently are the indigenous mammals of Australia passing into the category of the extinct, than are the inhabitants of any of the other large land masses of the globe. Large, conspicuous, and commercially valuable mammals are in some danger of extermination everywhere. But Australia holds this distinction; she is losing all her mammalian fauna from the largest and most conspicuous to the smallest and the most obscure.

There are several factors which combine to effect this wholesale destruction. First, the introduced carnivores, the fox and the cat, can outwit and destroy the native fauna wherever they come into contact. Second, the rabbit, the sheep and the cattle have raised the standard of competition for vegetable food to such a pitch that the herbivorous marsupials cannot survive in the struggle for existence. Third, such arboreal forms as are phytophagous, and are not subjected to this competition, are mostly valuable fur bearing animals, and it must be remembered that the fur trade of Australia is wholly destructive. The remaining factor is one due to geographical conformation and climate. In Asia, in Africa, in America and in Europe extermination of mammalian faunas is comparatively slow, since there are places

in the interior, wild regions in mountains, forests, swamps, and uncultivated yet fertile districts to which the animals, driven before advancing civilization, can retreat. So far as the western and southern parts of Australia are concerned these natural sanctuaries do not exist. The interior of the continent is not a place of refuge for the native fauna; it is a place in which competition for every blade of grass is raised to a standard unattainable by the very unsophisticated marsupial.

It may be said that the Australian marsupial has two slender chances of self preservation. It may be driven to the interior where in times of drought the severity of the struggle for food and water is marked by the carcasses of the introduced herbivores that have perished. Or it may be driven to the more populous districts where food is in comparative plenty; but where man, cats, and foxes are all intent upon compassing its destruction.

Among the animals that have chosen this last alternative, *Trichosurus vulpecula typicus* stands out conspicuously. Universally, and certainly permanently, known throughout Australia as the "opossum," this phalanger is to a great extent a suburban animal. In Adelaide at any rate, the opossum (for it is useless to persist in naming it the common, or vulpine phalanger) has adapted itself to modern circumstances better than any other marsupial. Wherever sufficient native timber has been permitted to remain, so as to afford a shelter, there will opossums be found. More than this, the animal has to a large extent adapted itself to become independent of the big eucalypti, in the holes of which it has its natural home. It has learned that the space under the roof of the usual type of suburban bungalow affords an excellent shelter and in such situations it freely takes up its residence. In this opossums have earned the ill will of the suburban householder, as their activities are nocturnal and noisy.

They are also in ill repute since disfiguring stains on ceilings often mark the site of their residences above, and contamination of gutters is an important thing in a place where water collected from the roof is of the utmost value. Moreover, the fondness of opossums for rose buds, and for the fresh young shoots of vines and fruit trees renders them unpopular with the suburban gardener. Practically every man's hand is against them, and yet they survive in a surprising way right up to the limits of the town.

Trichosurus is the only marsupial which seems to possess sufficient adaptive plasticity to be able to compete for survival in a suburban environment with any degree of success. And yet it must be owned

that an intimate acquaintence with the animal produces the impression that an inoffensive and stupid simplicity is the key note of its psychology. It is probably this simplicity which renders all opossums more or less tame, for there is very little difference in the degree of docility between a fresh caught adult and an animal which has been born and bred in captivity. A wild male has been in the habit of paying evening visits to my captive specimens, fearlessly coming into the outhouse in which their cages are placed. This visitor would permit me to approach and stroke it, but would not allow itself to be grasped or picked up. Freshly caught animals show practically no resentment of captivity, and when placed in a temporary cage are very reluctant to leave it for a larger and more comfortable one.

When handled, even when chased and captured, they, like most marsupials, remain silent; they will bite and scratch, and defend themselves stoutly, but as a rule they utter no cry. But though they are thus voiceless when molested by man, they are extremely noisy in their own domestic quarrels. The ordinary sound expressive of resentment, and a prelude to all encounters, is a long drawn inspiratory hiss. This hiss may die down as a harsh grunt, but when continued becomes increasingly high in pitch and may be modulated into a harsh cry, which rises to a raucous screech when the animals are fighting. During the breeding season, when fights are most common and the animals are most vocal, the male produces a curious sound like a sharp licking of the lips and a click of the tongue. So far, I have not heard a female produce this sound. The cry of the young when removed from the mother is extremely loud and quite peculiar, and can be described best by saying that it is so like the voice of the common South Australian tree frog that it is almost impossible to distinguish it from the frog's voice.

In fighting among themselves the oppossums use the claws of the fore feet far more than the teeth, and although they often inflict scratches on each other and remove quantities of hair, even the noisiest encounters usually result in no great damage to the opponents. In performing the toilet of the fur, the palmar surfaces of the hands are licked, and the face is washed after the familiar manner of the cat. The fur of the rest of the body is combed with the syndactylous digits of the foot. The syndactylism of the digits is most certainly, in all the syndactylous marsupials that I have watched, a specialization of structure adapted to the toilet of the hair. The second and third pedal digits, with their parallel nails, constitute a hair comb, and as

such they find their functional homologues in the procumbent lower incisors of the lemurs, the crenated lower incisors of *Galeopithecus*, and the specialized hair-scratching nails and claws seen in many mammals.

The hair is raked through by this specialized hair comb, and then the comb is cleansed by the tongue and teeth. Not only is this toilet-use the obvious function of these digits, but it is the only function that they possess, so far as I can learn after hours of watching at all times and seasons.

Trichosurus is a skilled, but by no means a nimble climber. When alarmed it seeks to escape rather by remaining motionless than by the exhibition of any feat of exceptional activity. Its movements, as a rule, are slow and cautious, and great reliance is placed upon the grasp of the prehensile tip of the tail. It is rare to see the tail grip released until the creature is well satisfied that it has a firm hold by some other member. The foot with its highly specialized and nailless big toe is capable of taking a very firm hold, and descent is always made head downwards. The hands are always used for gathering food, and for holding it to the mouth when eating. Opossums are crepuscular feeders, eating directly they wake at dusk. Less than many other marsupials are they dependent upon the native Australian vegetation, for though they relish the pungent leaves of the eucalypti, they will eat almost any green leaves, and their great fondness for flowers is one of the reasons for their unpopularity. They drink but little and are quite independent of water when a plentiful supply of fresh green vegetation is to be had. When they do drink, they lap the fluid with great rapidity. Like wallabies and bandicoots they have the strange habit of licking their fur in very hot weather. The fore limbs especially are always kept wet when the animal is suffering from the extremely high summer temperatures.

Of its means of keeping in touch with its environment its auditory sense and its tactile sense apparently take first place. Its sense of hearing is remarkably acute. The long ears are pricked and mobile when the animal is active, but are folded during repose. The tactile areas of the rhinarium and the naked pads of the hands and feet, as well as the numerous sensory vibrissae on face and limbs, are evidently of the highest functional importance.

Vision, even during the time of the animal's highest activity, does not appear to be at all keen, and seems to be of secondary importance only. I have had a fine male, three parts grown, in which there was complete double congenital cataract. This specimen came to grief

by appearing abroad in full daylight and being caught by dogs, but from its fine condition it was evident that it had no difficulty in finding its way about and obtaining its food. As is not at all unnatural in an arboreal animal, the sense of smell is by no means highly developed, and it seems to be of but little importance in obtaining food or in avoiding enemies. The human scent appears to be in no way objectionable to the Australian opossum. It is astonishing how long it will take a captive animal to discover food placed in its cage when it is so situated as not to come into immediate contact with it. There is no doubt that captive animals can recognise the individual who habitually attends to them, but beyond that there is no advance in what may be termed the education of captivity.

The breeding season is in June. I have not been able to gather one scrap of evidence that the animal breeds twice in the year, though it is commonly asserted to do so. The animals begin to breed in the year following that in which they are born. The advent of the breeding season is marked by a conspicuous increase in the size of the testes in the male. So far, I have observed neither copulation nor birth, but a series of notes upon the reproduction of a pair in captivity may be of interest.

An old male, and a female of the previous year, were put together in May. The female was considerably smaller than the male, and for a month he bullied her rather badly. In June they were on better terms; but towards the end of the month the female became very savage with the male, and would not permit him to come near her. On June 23 the female was noticed licking her pouch, the opening of which she dilated with her hands. On June 25 she was seen to stretch the pouch open with her hands, and thrust her nose into the opening. This process was watched repeatedly; she would not permit me, however, to examine the pouch. Within a few days the quarrelling became so constant, and the attentions to the pouch so frequent, that on July 3 the male was removed from the cage. On July 17 I left Adelaide, and up to that time I was unable to examine the pouch or even to see into it while she opened it to lick it or thrust in her nose. On September 17 I returned. The female was walking with a distinctly waddling gait, and the pouch was obviously enlarged. She now permitted me to feel the exterior of the pouch, and the contained embryo was distinctly palpable. I could however get no view of it since the animal has voluntary control over the musculature of the pouch, and she contracted the mouth whenever I examined it.

On September 19, whilst she was feeding quietly, the mouth of the pouch was seen to dilate, and a part of a red, hairless embryo was seen. The pouch however contracted whenever I touched it. On September 23 the pouch again opened whilst she was being watched, and the embryo, now dusky with developing hair, was observed for a long while. At this stage, when the body first becomes clothed with hair, the pelage is of a uniform dusky brown. On October 4 the young one kicked both its hind legs out of the pouch, and when it had withdrawn them left its tail protruding. On October 9 it first left the pouch for a very short time. Its eyes were open; its dorsal surface was brown and its ventral surface yellow. The mother cleaned it by licking, as a cat cleans a kitten; she restrained its movements with her hands, and thrust it back into the pouch with her nose. It reappeared outside the pouch on the 10th, but for a short while only. For the next 4 days it did not come out of the pouch while the female was under observation, but on the 15th it came out an spent most of the day closely folded against its mother's ventral surface. On the 25th the mother first came out to feed leaving it behind in the sleeping box.

On the next day the young one was taken and examined and the mother showed no signs of resentment until it cried. It was a male, and it was difficult to believe that it and its mother belonged to the same species. It was covered with fine and close hair of a red brown colour, its dorsal surface being brown and its ventral surface a fine bright yellow tan. It clung remarkably tightly to its mother's dense fur, gripping the fur with its sharp claws, and encircling her body with its prehensile tail. By the end of October it could feed itself, but although growing rapidly it still spent a great part of its time in its mother's pouch. During the first week of November she showed signs of impatience with it and turned it away from the pouch with her nose when it attempted to get inside; though she still permitted it to insert its head for the purpose of suckling.

On November 16 I left Adelaide, and on my return on the 27th the young one was independent of its mother. Its appearance had altered. Its coat had become a good deal more woolly, and the grey tint of the adult was apparent along the middle of the back. This canescence appears to take place without any moult. By the end of the year it had completely lost its brown and tan colour, its coat had become gray and woolly all over, and it was in all respects save size similar to the adult. By the end of January it was practically as large as its mother.

FEMALE TRICHOSURUS VULPECULA WITH POUCH OPENED AND SHOWING THE LARGE YOUNG

ADULT FEMALE TRICHOSURUS VULPECULA
Photos by F. Wood Jones

(Jones: Habits of Trichosurus vulpecula.)

UNIV. OF MICH.

It is usually said that four nipples are present in the female of *Trichosurus*. It is well known that the number of nipples is subject to considerable variation in several Australian marsupials; no specimen of *Trichosurus* that I have so far examined has had more than two. It is also often said that two young are produced at a time. I have handled a very large number of embryos and so far have not met with a case in which more than one was present.

University of Adelaide, Adelaide, South Australia.

THE OCCURRENCE OF A STERNAL GLAND IN ORANG-UTAN

By Adolph H. Schultz

[*Plate 14*]

During the examination of a fetal male orang-utan (crown-rump length 145 mm.),[1] in which the lanugo was still for the most part microscopic, the author's attention was attracted to a small circular pit in the middle of the smooth skin of the chest. This pit was easily visible and a closer study proved beyond doubt that it was not due to injury, but was evidently a natural opening in the skin. An older male orang-utan fetus, near term (crown-rûmp length 230 mm.),[2] showed the same pit at a corresponding place on the chest (see figure 1). From this specimen an area of skin, including the pit, was removed and sectioned. The histological examination of the sections cleared up the nature of this structure. It was found to be the opening for a considerable number of large sebaceous glands conglobated beneath. The pit is situated in the midsagittal plane, slightly above a line connecting the nipples, and overlies the manubrium sterni. Based upon their location the gland may be termed *sternal gland* and its opening *sternal pit*.

The examination of a total of twenty-three specimens of orang-utan ranging in age from fetuses to very old specimens and including both sexes, revealed some interesting facts regarding the occurrence of this sternal gland. The author wishes to express his sincere thanks to Mr. G. S. Miller for his kind permission to study five preserved orang-utan fetuses and newborns and a number of adult skins in the National Museum; to Mr. N. Hollister for the opportunity to examine the orang at the National Zoological Park; to Mr. R. L. Ditmars for information regarding the orang at the New York Zoological Park; and to Dr. E. Huber for his careful notes on some preserved orangs of the University in Zürich.

The gland was found to be present in 12 out of 13 males and in 2 out of 10 females. The only male in which it was missing was a very old specimen, and this, together with the fact that in the fairly old orangs the pit was relatively much smaller than in the juveniles, would indicate that the gland degenerates gradually with advancing age. The only two females in which the pit was present were juveniles, the fetal,

[1] No. 143597 U. S. Nat. Mus.
[2] No. 153973 U. S. Nat. Mus.

infantile, and adult females showing no trace of it. It seems probable, therefore, that, while the sternal gland may develop in the female, it apparently does so in only a small percentage of cases. Its constant presence in males, with the exception of very old animals, and its sporadic occurrence in females tends to substantiate the assumption that we have to deal here with a secondary sexual character. However, the fact that this gland is found as early as the middle of fetal life does not conform readily to this theory.

The sternal pit is most evident in fetuses, where its umbilicated opening reaches a diameter of 2.5 mm. The skin patterns are arranged in circles around it and become very much finer and smaller immediately surrounding it. In juvenile specimens a low circular wall is frequently found at the edge of the actual pit. At this age and later most males have a round, dark brown pigmented spot, sharply circumscribed, with the sternal pit in the center. In the fetus, also, sections show a slight increase in pigment at the periphery of the pit, but a large accumulation of pigment does not occur until later in life. In some instances the sternal pit was not circular but oblong, in which case the longest diameter was always horizontal. Its depth in juvenile specimens was in several instances 2 mm. and amounted in one case to even 3.5 mm. In old males the pit is very difficult to find, due to the fact that it is almost always covered by long hair and hidden among the wrinkles of the skin or beneath the folds of the laryngeal pouches. The difficulty of detecting the gland in the full-grown animals, where the pit also is relatively smaller and shallower than in juvenile and fetal specimens, probably accounts for the fact that it has not, so far as the author can ascertain, been previously described. An important feature of the sternal gland is its constant position, which varies only within a few millimeters above or below a line connecting the nipples, and which always lies exactly in the midsagittal plane.

Figure 2 shows a section through the skin containing the sternal gland of the fetus shown in figure 1. The sections were cut in a perpendicular direction. One can see a canal emptying into the bottom of the spacious pit; beneath lie the large sebaceous glands. A study of all the sections showed that a number of these glands have one joint outlet, but there are also many others with minor separate openings into the pit. The sweat glands surrounding the pit seem to be unusually numerous and of more than average size. In several cases microscopically fine hairs can be observed on the edge, and in one instance at the bottom of the pit.

In one juvenile male orang, in the National Zoo, one can feel the glandular body, which is approximately the size of a pea, beneath the pit. After some palpation a tiny drop of apparently crystal fluid exudes from the opening.

In conclusion it may be stated that during the examination of a considerable number of preserved bodies of fetuses and adults of many different species of monkeys and apes no trace of anything comparable to this sternal gland in the orang-utan was found. It seems certain that this gland is not present in the adult chimpanzee, gorilla or gibbon, nor in the last mentioned in a fetal stage. It is impossible at present to say what purpose the sternal gland in the orang may serve. The odor of its secretion and the time of its maximum functioning would probably throw light on this question. An accumulation and concentration of glands in the region of the chest is known to occur in marsupials (*Myrmecobius*, *Didelphis*, *Trichosurus*, and *Petaurus*), where their opening lies for the most part in a hairless region. Some forms of Chiroptera likewise have large glands in the middle of the chest. In these mammals also, the glands are more strongly developed in, or even entirely restricted to the male.

Carnegie Institution of Washington, Dept. of Embryology, Baltimore, Md.

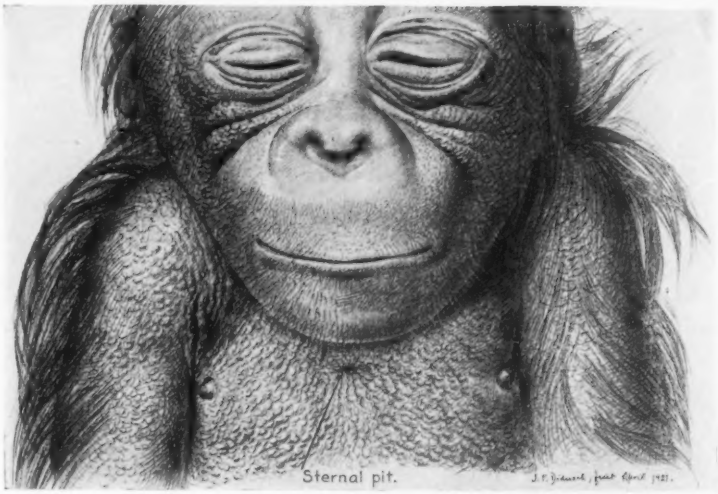


FIG. 1. FRONT VIEW OF MALE FETUS OF ORANG-UTAN SHOWING THE STERNAL PIT

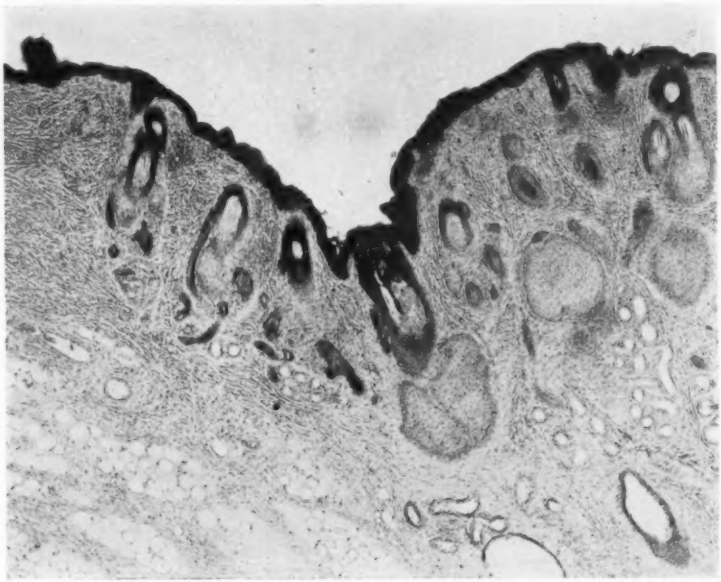


FIG. 2. PERPENDICULAR SECTION THROUGH THE STERNAL PIT AND GLAND OF THE ORANG FETUS SHOWN IN FIGURE 1. 45 × ENLARGED

(Schultz: Sternal Gland in Orang-Utan.

UNIV. OF MICH.

SOME OBSERVATIONS ON BEAVER CULTURE WITH REFERENCE TO THE NATIONAL FORESTS

By Smith Riley

The Federal Government has been entrusted with the responsibility of protecting and bringing to their highest use 156 million acres of public forest land in this nation. The protection, culture and use of the trees, of course, is the first purpose. However, when full consideration is given to the variety of the types embraced in these reservations, it will readily be seen that the possibility of cultural use covers an enormous field. Obviously, in the establishment of reservations to cover certain types of land, full recognition must be give to the place these lands occupy in national use and no opportunity should be lost to have them do their part in economic production. There are many uses to which lands producing trees can be put without interfering with the principal purpose.

It has been said that the demand for fur has existed since primitive man sought skins to shield his body from the cold. This demand is fundamental and will endure while man inhabits the earth and furs are to be had. Its strength can be judged by the volume of trade it supports. In 1913 the dressed and manufactured furs imported into the United States were valued at more than $15,000,000. North American furs annually marketed in the United States and England have an approximate value of $60,000,000. These figures show the commercial importance of fur, and in addition to this the fur trade furnishes a livelihood for many thousands of workers in the factories and stores of the country.

The fur resources of the United States have been destructively used throughout the whole life of the nation. In the history of the fur trade there is not one instance of constructive action looking to the building up of this valuable resource. In Chittenden's accounts of the far western trade he repeatedly refers to the detrimental results in the destructive methods employed in the development of the trade. In the early days the Government refused to limit the competition which did more than anything else to decrease fur production. Of later years as some states passed laws controlling the taking of fur-bearing animals nothing has been done to define fur production areas or to stabilize production by ascertaining that amount of fur of the different kinds which a given region should produce. That such action was entirely possible is shown in the experience of Canada,

where the strife of rival companies bid fair to destroy a vast resource when steps were taken to limit the activities of each company to a given region. This act alone, aside from any laws controlling the catch, did much to stabilize the industry through permanent interest in production from a given region over a long period of time. The trappers dealing with the companies were encouraged to leave animals for breeding. Later, I believe, laws were enacted to enforce this very point.

In many of the states where there are National Forests trapping beavers is prohibited, though provision is made to take such animals as destroy property. Little interest is taken in the protection of fur-bearing animals, with the result that applications to take beavers on the grounds of active damage are not investigated, resulting in much taking of beavers without compliance with the laws for protection.

Where there are closed seasons or where trapping fur can be carried on only under permit, no attempt has been made to ascertain the productive capacity of the region, with the result that, even with the closed seasons upon some of the more important animals, in many of the states, the fur resources of the United States have steadily diminished during the last half century, far beyond any justification. Present conditions point beyond a doubt to further shrinkage. The decrease has been in the quantity of the better pelts and not in the total value of the catch.

Beavers, otters, martens and fishers have disappeared from much of their former range, and even minks, raccoons, and skunks have become scarce in some localities. The result is that many kinds of thinner furs have come into the market, with an almost prohibitive price upon beaver fur. The following statement is taken from Chittenden's History of the Fur Trade in the Far West:

> The great importance of the beaver in the life of the hunter and trapper arises almost entirely from the commercial value of its fur, which is one of the finest that nature produces. At this early period in particular it was in great demand. An average price was four dollars per pound and as the little animal carried from one to two pounds on its body the premium for its destruction was from four to ten dollars according to the size and the prevailing price of furs. As the streams of the west—of the whole country for that matter—originally swarmed with these animals in numbers that rivaled the illimitable buffalo herds of the plains, it will be readily understood what a mine of wealth here lay open to the industry of the trader and the trapper.
>
> Every stream of the west was as rich as if sands of gold covered its bottom—a richness moreover, which if gathered with judgment and not to the degree of extermination, would renew itself by natural increase.

The beaver also supplied another article of commerce, a secretion from two small glands of the body. This was always known in the commerce of the mountains as castorum. In the arts it is more commonly called castor. In the mountains its value was about three dollars per pound. The castorum was used as the beaver's bait, and thus the little animal itself supplied the means of alluring its race to destruction. The extensive use of the beaver fur in the early years of the century caused an increase in exportation from America to Europe, reaching as high as 200,000 skins annually. This great draught on the supply led to the rapid extermination of the beaver.

In Mr. Chittenden's book, The Yellowstone, is the following statement: "but a business carried on with such relentless vigor naturally soon taxed the resources of nature beyond its capacity of reproduction. In regions under the control of a single organization, as in the vast domains of the Hudson Bay Company, great care was taken to preserve the fur-bearing animals from extinction. In the United States territory the excess of competition made any such provision impossible."

There is not an instance in any section of the country of a departure from the original destructive policy. It is true, protective laws have been passed by many of the states but under the existence of the laws there has been no systematic study of a plan for stable production. The growing sentiment for wild life preservation coupled with the realization of the place beavers fill as water conservers in the irrigation regions has done much to direct attention towards better methods of protection. This has been particularly noticeable in those states where there has been a closed season and the animals have increased to such an extent that a cry has been raised of damage to crops. Those who wish to prey upon the beaver seek to gain their ends by noising their destructive tendencies.

There is no question about the damage done by beavers to both ditches and crops, so their development in an agricultural district requires constant attention to prevent damage. In face of this fact there are many ranchmen or agriculturalists who accept the trouble entailed by the animals for the satisfaction of having them upon their property.

In Colorado, which has had a closed season for many years, with a provision in the law for taking such animals as cause damage, the beavers have, in spite of the wholesale disregard of the law, increased to such an extent that repeated efforts are being made to change the law so that the animal can be taken without restriction. This shows their persistence and what might be done with them where

suitable culture areas are available. There is much stream area in the range of ditch-heads and cultivated lands where beavers can exist to advantage with little property loss. I do not believe there exists any general sentiment among those interested in lands of this type for the complete elimination of the animals. There are those who deplore the property loss and would destroy the beavers completely, feeling that property should be first and seeing no value in the animals. There are those who covet the products of the beavers and agitate the damage feature to gain the assistance of those who would destroy the animals to protect property. Considering the failure of two legislatures to open the season, I feel that those in favor of protection are in the majority.

If there were to be considered only the stream-reaches in the range of ditches and cultivation, the general conditions would offer many features encouraging to a study of a workable plan for production. When we add to this the many miles of suitable water well supplied with food and entirely removed from conflicting interests, the possibilities for a substantial return from the lands and the development of an industry which will not interfere with the land production in other ways appear very feasible. The National Forests are for the most part mountainous lands which will remain in a wild state and they therefore offer excellent culture areas for fur animals. Another point which should be given full consideration is that the forest lands controlling the upper waters of all the principal streams in the mountain country are the natural culture grounds for these creatures. Besides, the nature of the administrative units creates an obligation for the complete production from the lands.

The present status of the beaver in the Cochetopa Forest in Colorado is an excellent example of what can be done in the average mountain region suitable for beaver culture. It is estimated that this Forest which covers some 900,000 acres contains 12,000 animals distributed over about half the available water area suitable for production. As the animals were causing damage to ranch property in one locality near the forest boundary, a plan was drawn up for coöperative trapping with the state game department. It provided for the extermination of the beavers where they were committing actual damage; for their increase unmolested in streams of the Forest not fully stocked; and finally for the transplanting of the beaver to streams where they do not at present exist, and where food and other conditions are thought favorable for their propagation.

The trapping was done on Cochetopa Creek. This stream, about 15 miles in length within the Forest boundary, has an almost continuous series of dams from the boundary to above timber line. Below the Forest there are several ranches where the beavers were causing damage. The damage consisted in flooding hay meadows and obstructing irrigation ditches, and was investigated by the local forest officers before a recommendation for the trapping was submitted. The stream, therefore, afforded a combination of both conditions under which trapping was justified; that is, a fully stocked stream and also a locality where the ranchers were suffering actual damage.

Upon the recommendation of the Forest Service, a trapper was sent by the state with instructions to work under the direction of the forest supervisor. When he arrived the latter part of April, the work was outlined to him as follows: (1) To try to exterminate the beaver on the ranches below the Forest where the owners desired this to be done, and for a distance of half a mile within the Forest to prevent interference with a big irrigation ditch; (2) to reduce the number for a distance of about five miles within the Forest, to give the remainder room to increase without working down upon the ranches and causing an immediate recurrence of damage; (3) to leave those on the upper courses of the stream unmolested with the idea that, if the trapping proved too heavy or caused the beaver to migrate to another locality, they would work down the stream as they increased, thus restocking the portion trapped.

There was no actual evidence that heavy trapping might cause the animals to migrate, but the work being new and in a somewhat experimental stage, it was thought best to leave them undisturbed on a portion of the stream.

Ice prevented operations when the trapper arrived, so he put in his camp and looked over the ground in preparation for the work. He started trapping about the first of May and trapped until the first of June. During this time he caught 132 beavers with No. 4 Newhouse traps, using twenty.

In regard to costs it is regretted that actual figures can not be given as the local forest officers did not know definitely whether the trapper was paid a salary or was allowed a part of the hides. However, regardless of how the state handled the matter the net revenue must have been considerable, in view of the size of the undertaking. The local forest office was informed that some of the hides brought as high as $33, and that the total gross returns were $3,000. Assuming that

the state was able to hire the trapper for $100 per month, and that the expense of the trip was about $100 in addition, which seems reasonable, the cost of trapping the beavers would be about $1.50 each.

The trapping was not sufficiently thorough, on and in the immediate vicinity of the ranches, in that the beavers were not exterminated, and they may again become a source of damage. However, if trapping can be done at frequent intervals on the stream, this will likely be obviated.

Along the five-mile stretch within the Forest, there is a noticeable reduction in the number of beavers, but this is not as marked as might be expected. Observations made the following fall indicate that with three or four exceptions all dams within the stretch are still inhabited. This would indicate that the trapping within the Forest has been sufficiently conservative; and if desired, the stream could be safely trapped again next spring without reducing the stock below normal; that is to say, probably not more than the normal annual increase for the stream has been trapped. It is planned to make further observations of the results next summer, and to defer recommendations for further trapping on this stream for the present. It is planned, if the state can be induced to send one, or preferably two trappers, next spring to undertake similar work on two other creeks, both of which are heavily stocked and along which some damage to ranches is occurring.

It might be added further that the estimate of the number of beavers in Cochetopa Creek and tributaries was 1,200, and that the apparently small reduction in numbers following last spring's trapping would indicate that this estimate is conservative. It is more likely under rather than over the actual number. It might also be added, that 20 beavers were trapped from this same locality on the stream under permits to local ranchers, the fall before the state trapper undertook the work, making the total number trapped from the stream during the past year 152.

The State trapper failed to take any of the beavers alive for planting, so a permit was issued by the state to the forest officers to do the live trapping.

It was planned to use the woven-wire-corral method of trapping the beavers, but owing to the lateness of the season and probable length of time it would take to get them in this way, ordinary steel traps were resorted to and they were visited at short intervals so that any animals caught would not injure themselves. It is realized that this was a very

crude way to do the work, and might result in considerable injury to the specimens taken. Fortunately this was not the case with the two trapped, and both of them were removed from the traps without suffering severe injury.

An ordinary box was made 2 x 2 x 3, with sliding door, for transporting the animals. One quarter inch cracks were left between the boards to allow for air. It was lined with chicken wire to prevent the animals from gnawing, and both were placed in the same box. They made no attempt to gnaw out and caused very little disturbance while in the box, being comparatively docile after being once captured. One was inclined to fight while being removed from the trap, until released from it. The first one was placed in the box directly from the trap; the second one was carried to the box in an old gunny sack. It scratched around some, but did not attempt to gnaw its way out. The two captured were two-year-olds. In trapping the pair an extra male was caught. It was transferred to Carnero Creek with the idea that we might later be able to get a mate for it, but we were unable to do so.

The beavers were transported by automobile from the place trapped on Cochetopa Creek to the upper Saguache Ranger Station, and thence by wagon about 10 miles to where they were released in Houselog Creek. The first beaver captured was in the box three days and two nights before being released. He apparently suffered no injury from the confinement or from the long period out of the water. Both were in good condition when released in Houselog Creek.

The beavers were released just above the upper ranch on Houselog Creek. The sentiment of the local ranchers and homesteaders along the creek is favorable to the propagation of beaver, they feeling that if the stream becomes stocked, they will benefit through the holding back of the water, making more for irrigation in the late summer.

It is, of course, too soon to predict the result of the work, but it is thought that it will be successful. There is an abundance of aspen along the stream for food. Two or three weeks following the release, little was seen of the beavers, but aspen cuttings were observed at different places along the creek. They apparently wandered around considerably before settling down; but the last observations of Ranger Gallegos showed that they had established themselves just above the fence of the upper ranch on the creek, and had built a den in the bank. They have not built a dam, but it is doubtful if this is essential, since some of the beavers in this locality do not construct dams.

When the beavers were released from the crate and turned into the creek, they were apparently somewhat bewildered. One started up the creek and the other down. In order to keep them together, Ranger Gallegos headed off the one going down the creek, and started chasing it back toward the other one. The empty crate was lying on the bank, the beaver in passing it evidently regarded it as a place of protection, and ran back into it. Ranger Gallegos then closed the sliding door, and carried it up stream to the other one and released it. In the meantime, the other one had worked up stream, and finding a hole in the bank, stuck his head into it and remained there. He was prodded up with a stick, but would not move, seemingly considering himself out of sight and protected.

The plan of management provides for the restocking of all streams of sufficient size in which beavers do not at present exist, and along which there is sufficient aspen or other food for them. There are only five such streams on the Forest. It is hoped to continue the work until a small breeding nucleus is placed in each of these streams, with the coöperation of the state if it can be secured. Judging from the results of three transplanted in Itasca Park, Minnesota, in 1900, and the rate at which they are thought to be increasing there, a large nucleus will not be necessary; but if sufficient coöperation is extended by the state in the way of furnishing a professional trapper to assist, four to six per stream would be better. This would serve to bring up production in the shortest period of time and serve to show what improvement in stream conditions can be expected from the ranchmen's point of view. A clear demonstration of the stabilizing effect upon the stream flow of beaver activities will be of value in fixing their place.

It is planned as an experiment to try to catch them with a woven-wire crate or net placed with the opening over the entrance to the house or to the entrance of the den in case of bank beaver, first closing up the other one of the two entrances. Then, by poking them up in the den, it is proposed to force them out and into the net. This should work during the daytime, since from what information there is available they remain in the dens or houses during the day, and are not easily disturbed. This has been talked over with one or two of the local trappers who think it feasible. If it fails, the wire-corral method will be used.

Also in undertaking any future work, it is planned to catch the beaver earlier in the season, preferably about the first of August, since high water is then over, making it easier to trap them, and allowing the

planted specimens more time to become located, build a house and store food before winter sets in.

The estimate made of the beavers in 1918 showed 12,000 in the streams within the vicinity of the Forest. While this may have been a little high at the time, it is believed to be conservative at the present time. Anything approaching an accurate census, however, has not yet been made. On streams, like Saguache Creek, which are subject to flooding and washing out of dams, not nearly all of the beavers construct dams. They often simply burrow into the bank and make dens without them. This fall numerous runways and cuttings of willows were observed along the creek, and dens without dams. The observations of local trappers and also of the state trapper agree with the information given by the Biological Survey that they average about four kits to the litter. From information obtained from Mr. J. D. Figgins of the Colorado Museum of Natural History, they have a litter each year, and the young ones remain with the old until they are two years old, or until the third litter is born. This would indicate that there are two litters in most dams. There is one point, however, which has not been cleared up. That is, whether the secondary dams are also regularly inhabited. Some claim that the two-year-olds occupy them when pushed out by the parents, but there is a difference of opinion as to this. With the gathering of a little more information as to their habits, it is hoped to make a more accurate census, but it is going to require time and close observation.

Likewise, there is very little information about natural losses and rate of increase. Estimates of the numbers in Long Branch Creek showed 50 beavers in 1908 and 3,000 in 1918, indicating an average yearly increase for the period of about 50 per cent. This, however, is based only on estimates. In order to be conservative, an annual increase of 25 per cent has been assumed until such time as more accurate information can be obtained. It is evident at any rate that they increase rapidly, judging by the new dams constructed each year.

I have traveled for days on end through the Forests of Wyoming over lands of first quality for fur animal production. A trapper at Valley Wyoming wrote me not long ago that he had out 200 miles of trap lines and he was not doing so well because the martens were scarce. That while there was lots of feed such as rabbits and squirrels in the region where he was trapping, the martens were not there and he thought they had just been trapped out. In fact, he believed the only hope for the marten is a closed season.

The Forest Service has an agreement with the Wyoming State Game Department which provides that all applications for trapping permits will be submitted to the forest supervisor concerned for consideration and recommendation before action is taken. Now it is true that the present state game warden, dealing in generalities, has expressed himself in favor of the destruction of all fur animals because he claims they prey upon game birds. Upon the other hand, the Wyoming law is so worded that the issuance of trapping permits is discretionary and there are some eight forest supervisors supported by observant rangers conversant with all animal range types in the state. Surely an active force of such size in a fertile field should be able to bring forth sufficient evidence to convince one man of the unsoundness of his position. Game birds were plentiful in the Shoshone National Forest when I first knew it fifteen years ago at a time when fur animals were much more numerous than they are now. Food and seasonable weather have far more to do with the prevalence of game birds, say the grouse family, than the presence of fur animals. Continued cold wet weather when the chicks are just hatched plays havoc with game birds just as a scarcity of food in any section may cause the birds to migrate. The weasel, I have no doubt, is most destructive to all bird life; however he is not much sought by the average fur trapper.

My idea would be the preparation of maps of the Forests for the state game warden designating certain watersheds where trapping of stated animals should be prohibited for a given period of years. There must be sound reason for this recommendation, set forth in detail. Such elimination of the taking of fur animals to let them reach a normal production should not in any way interfere with trapping wolves, coyotes and cats.

Certainly the subject of fur production offers an excellent field for action with obligations for initiative upon the proprietors of the land best suited to such purposes.

Washington, D. C.

UNIV. OF MICH.

A TREE-CLIMBING WOODCHUCK

Marmota monax preblorum

(St. John: Tree-Climbing Woodchuck.)

A TREE-CLIMBING WOODCHUCK

By Harold St. John

[*Plate 15*]

In June, 1920, the New England Botanical Club held its annual spring field trip in the upper Connecticut Valley. To Mr. Richard J. Eaton and myself was assigned a territory including Quechee Gulf in eastern Vermont. On the afternoon of the 12th, we had clambered along the base of the cliffs on the north side of this deep gorge, and at the lower end crossed the Ottauquechee River and started up the hillside to the south of the river into the town of Hartland. In the midst of an open pasture I stooped to dig a prostrate plant, and as I rose I saw that Eaton, who had walked ahead towards a clump of trees, had stopped and was beckoning to me. He had scared a woodchuck from the open ground and it had run to the trees and climbed six feet up a tree eight inches in diameter. While it hung there watching us, I drew out my camera and took a snapshot at a distance of thirty feet. Still the woodchuck clung to the tree trunk, so I quietly approached to within six feet and snapped another picture, which is here reproduced. My companion then joined me and finally stepped up and stroked the animal on the back. This was to confirm what we saw, that the animal had fur, not quills on its back, and to make perfectly sure that it was a woodchuck, not a porcupine. We were close enough to see that it was a female. On being stroked, she hitched around to the opposite side of the trunk. After hanging there a minute, she turned, dropped to the ground and scuttled off, disappearing in a thicket.

Whenever I have related this incident, it has met nothing but incredulity. After my long acquaintance with the woodchuck in southern New England, I am afraid that I too would have been inclined to doubt the accuracy of anyone telling me that woodchucks climbed trees. Yet Eaton and I certainly saw the thing done, and I am lucky enough to have a good photograph to substantiate my statement. It seems desirable to put this bit of field observation on record.

State College of Washington, Pullman, Wash.

ON THREE NEW MAMMALS FROM JAPAN

By Nagamichi Kuroda, M.A.S.M.

The following mammals from Japan seem to be undescribed. They are preserved in my own collection. All measurements are in millimeters.

Sciuropterus russicus orii subsp. nov.

Characters.—Resembles *S. russicus russicus* Tiedemann of Siberia and Russia, but the greatest length of skull and mandible longer, the breadth of interorbital constriction narrower, the length of upper and lower tooth-rows shorter. It differs from *S. russicus athene* Thomas of Sakhalin, by the much paler coloration of body, by the greatest length of skull longer, by the zygomatic breadth wider, by the palatal foramina longer, and by the upper tooth-row shorter. It essentially differs from *S. momonga momonga* (Temminck) and *S. momonga amygdali* Thomas of Japan.

Description.—Upper parts a uniform pale silvery gray, with a clay cast; the region of crown and nape tinged with a deep tone of the color; lores and cheeks paler and almost white; a narrow blackish eye-ring; under parts and

Dimensions of the type and other specimens

LOCALITY	DATE	HEAD AND BODY	TAIL	HIND FOOT	EAR	SEX	MEASURED BY
Kushiro, Hokkaidō.....	1909	150	121	34	20	♂	H. Orii
Kushiro, Hokkaidō.....	1909	147	118	35	19.5	♂	H. Orii
Uyenai, Iburi, Hokkaidō .	February, 1915	153	105	33.5	21.5	♂	H. Orii
Uyenai, Iburi, Hokkaidō .	February, 1915	146	97.5	32.5	20	♂	H. Orii
Uyenai, Iburi, Hokkaidō .	February, 1915	148	112	32	20.5	♂	H. Orii
Uyenai, Iburi, Hokkaidō .	March 13, 1920	163	117	34	19.5	♀	H. Orii

Comparative measurements of skulls of three forms of S. russicus

SUBSPECIES	GREATEST LENGTH	BASILAR LENGTH	ZYGOMATIC BREADTH	POSTORBITAL CONSTRICTION	INTERORBITAL CONSTRICTION	ROSTRAL BREADTH AT FRONT OF NASAL	NASAL	DIASTEMA	PALATILAR LENGTH	PALATAL FORAMINA	LENGTH OF BULLÆ	MANDIBLE	UPPER TOOTH-ROW	LOWER TOOTH-ROW	MEASURED BY
*S. r. orii**...	39.5	30.5	24	9.0	7.5	6.5	13.0	8.0	17.0	5.5	10.5	24.5	6.5	6.5	Kuroda
S. r. athene..	37.0	28.0	22	—	7.0	—	—	—	16.2	4.8	10.1	—	7.2	—	Thomas
S. r. russicus	36.2–36.8	—	24‡–24.2	9–9.4	8.4–9	6.4–6.8	12.8–13.2	8.2	—	—	—	23.2	7.2–7.4	7.2	Miller

* Type specimen.

inner surface of limbs pure white with ashy bases to the hairs; tail distinctly buffy on marginal parts and blackish on the median area; upper surface of hand dusky, and that of hind foot grayish white; hairy part of soles grayish white; lower surface of toes naked.

The type specimen was obtained by Mr. H. Orii at Uyenai, Prov. Iburi in Hokkaidō, March 13, 1920, and was presented by him to my collection. The subspecific name is given in honor of the collector.

Mustela rixosa namiyei subsp. nov.

Mustela nivalis Linnæus, subsp., KURODA, Annot. Zool. Japon., Vol. IX, p. 610 (1920).

Characters.—Resembles *M. rixosa pygmæa* (J. A. Allen) of Siberia, but the length of head and body longer and the tail decidedly longer. It differs from *M. rixosa rixosa* (Bangs) from Arctic America, by the smaller body. It also differs from *M. rixosa eskimo* (Stone), by the paler coloration of body, and by the somewhat longer tail.

Dimensions of the type and other specimens

SUBSPECIES	LOCALITY	HEAD AND BODY	TAIL	HIND FOOT	EAR	SEX	DATE	MEASURED BY
*M. r. namiyei**	Awomori N. Hondō	190	—	18.5	11	?	—	Kuroda
M. r. namiyei	Awomori N. Hondō	190	30	20	—	♀?	November 9, 1907	Namiye
M. r. namiyei	Near Sapporo, Hokkaidō	200	26	20.5	11	?	December 20, 1899	Kuroda
M. r. pygmæa	Siberia	158	16	21	—	♀	October 2, 1900	J. A. Allen
M. r. pygmæa	Siberia	184	19	23	—	♂	January, 1902	J. A. Allen
M. r. pygmæa	Siberia	166	13	19	—	♀	January, 1902	J. A. Allen
M. r. eskimo ..	Alaska	204, 230	28, 31	20	—	2♂s	—	Stone
M. r. eskimo ..	Alaska	178–184	22–25	16–23	—	3♀s	—	Stone

* Type specimen.

Comparative measurements of skulls of namiyei and pygmæa

SUBSPECIES	GREATEST LENGTH	BASILAR LENGTH	ZYGOMATIC BREADTH	INTERORBITAL CONSTRICTION	ROSTRAL BREADTH OVER CANINES	OCCIPITAL DEPTH	MASTOID BREADTH	LENGTH OF BULLA	MANDIBLE	UPPER TOOTH-ROW	LOWER TOOTH-ROW	MEASURED BY
M. r. namiyei	31.5	30	17	7.5	5.5	9	14.5	11	16	8.5	10.5	Kuroda
M. r. pygmæa.....	28.5	—	13.3	—	—	—	12.5	—	—	—	—	J. A. Allen

Description.—Upper parts a uniform pale cinnamon color, instead of dark reddish brown of *M. rixosa pygmæa*, including the outer side of fore and hind limbs to the base of toes; lower parts, inside of the limbs, fore feet, and apical half of hind feet pure white, the lower parts unmixed with any other mottling; edge of upper lip and lower half of cheeks white; ears very small, cinnamon haired like the upper parts; tail short.

The type specimen was obtained at Awomori, N. Hondō, Japan, and was presented to me by Mr. K. Wada. Date unknown.

The late Mr. M. Namiye examined a specimen of this animal obtained by Mr. E. Kinashi at Awomori, November 9, 1907, wrote a brief description of it, and named it after Mr. Kinashi ("Shokuniku Shōjū Rui Chōsa Hōkoku," Jan., 1911). This report was sent to the Department of Agriculture and Commerce, but unfortunately remains unpublished. For that reason I publish the more detailed description of this interesting animal under the above subspecific name in memory of Mr. Namiye.

The weasel is distributed from northern Hondō to Hokkaidō. Some weasels were obtained on Sakhalin, Kurile Islands, and on the Korean Peninsula, but I have not yet examined their skins.

It is a very interesting fact that the Japanese form belongs to the *rixosa* group of Arctic America rather than to the Old World *nivalis* (=*vulgaris*) group. J. A. Allen also mentioned the fact when he described his *pygmæa* from Siberia.

Pteropus daitoensis sp. nov.

Pteropus dasymallus (nec Temminck), KURODA, Annot. Zool. Japon., vol. IX, p. 599, 1920 (part.).

Description.—Fur of back long and spreading, especially on mantle and hind neck, where wooly in structure; ears short, half visible from the outside of the fur; sides of crown, face, cheeks, chin, lower half of the dorsal parts and flanks, as well as clothed parts of tibia and forearm, seal-brown; this hair tipped with grayish or buffy on center of lower back; center of crown, occiput, whole hind neck, mantle, breast and center of abdomen very pale whitish buff, faintly tinged with yellowish; crown somewhat sprinkled with seal-brown hairs; this pale color on center of crown passing through the forehead and reaching to the base of nose; a large golden buff patch on both sides of neck and continued in middle of fore neck; the pale area on center of abdomen sprinkled with seal-brown longer hairs; the bases of fur in all pale areas with the same color as the apical parts.

Measurements

	♂ AD. (TYPE)	♂ AD.
Forearm	130.0 (about)	127.5
Pollex, total length	60.0	54.0
2nd digit, metacarpal	67.0	64.0
2nd digit, 1st phalanx	17.5	18.0
2nd digit, 2nd-3rd phalanx	16.5	16.0
3rd digit, metacarpal	93.5	88.5
3rd digit, 1st phalanx	70.0	66.5
3rd digit, 2nd phalanx	96.0	85.5
4th digit, metacarpal	92.0	88.0
4th digit, 1st phalanx	59.5	52.5
4th digit, 2nd phalanx	59.5	52.5
5th digit, metacarpal	96.0	93.0
5th digit, 1st phalanx	45.5	41.5
5th digit, 2nd phalanx	47.5	41.0
Ear	22.5	19+x
Ear, greatest width flattened	16.5	—
Front of eye to tip of muzzle	25.0	—
Tibia	—	62.5
Foot with claw	43.5	40.5+x
Calcar	15.5	15.0
Skull, greatest length	—	62.5
Skull, basilar length	—	57.5
Skull, zygomatic breadth	—	34.5
Skull, width of brain-case at zygomata	23.0	23.5
Skull, postorbital constriction	7.5	7.0
Skull, interorbital constriction	10.0	10.0
Skull, orbital constriction	—	12.0
Mandible, length	48.5	48.5
Upper tooth-row	23.5	24.0
Lower tooth-row	27.0	27.0

The type specimen was obtained on Kita-Daitōjima, Daitō Islands, one of the Southeastern Loo-Choo group. The above two specimens were presented to me by Mr. S. Uchida.

This species is closely related to *Pteropus dasymallus* Temminck of South Loo-Choo Islands, but the coloration is wholly different.

Fukuyoshi Cho, Akasaka, Tokyo, Japan.

A NEW PINNIPED FROM THE UPPER PLIOCENE OF CALIFORNIA

By Remington Kellogg

During the month of December, 1920, the writer, in company with Mr. E. L. Furlong, spent several days examining California collections of marine mammals. This work was undertaken under the auspices of the Carnegie Institution of Washington and under the direction of Dr. John C. Merriam. Although search for pinniped remains was not the principal object of this trip, a number of fossils were located, among which the most important were contained in the collection of Stanford University. These specimens were generously placed at the writer's disposal for study and description by Dr. David Starr Jordan and by Prof. J. P. Smith.

The material figured and described in the present paper was discovered by Mr. Robert Anderson in a Pliocene formation of southern California and belongs to the Geological Department of Stanford University. Dr. Joseph Grinnell, director of the Museum of Vertebrate Zoology, and Mr. Gerrit S. Miller, Jr., curator of mammals of the United States National Museum, have greatly facilitated the writer's studies on fossil Pinnipedia by the loan of skeletons of the living pinnipeds for comparison. These fossil bones have been compared with a number of the living pinnipeds besides *Eumetopias*, notably with *Zalophus*, *Arctocephalus*, *Callorhinus*, *Odobenus*, *Monachus*, and *Mirounga*, as well as with other fossil genera, the descriptions of which are now in press. In this paper comparisons are made with *Eumetopias jubata* (No. 8821, Mus. Vert. Zool.), *Zalophus californicus* (No. 16296, U. S. Nat. Mus.), *Odobenus divergens* (No. 21331, U. S. Nat. Mus.), and *Mirounga angustirostris* (No. 15270, U. S. Nat. Mus.). The illustrations for this paper were made by Mrs. Frieda Abernathy.

Fossil remains of the family Otariidæ are very little known. There are several extinct otarids on record, but many of these are based on very scanty and dubious material. This statement is especially true of teeth of doubtful reference found in France. In North America no evidence for Tertiary otarids on the Atlantic Coast has been recorded. True, in 1905, described *Pontolis magnus* from beds belonging to the Empire formation at Coos Bay, Oregon, based on the occipital and basicranial region of the skull. No limb bones were described by True[1]

[1] True, F. W., Smithsonian Misc. Coll. (Quart. Issue), vol. 48, pt. 1, no. 1577, p. 48, Washington, D. C., 1905; Prof. Paper No. 59, U. S. Geol. Surv., Dept. Interior, pp. 144–147, pls. 21–23, Washington, D. C., 1909.

and thus far no limb bones have been recorded from the Empire formation. Until such are found, it will be impossible to show the relationships of *Pontolis* to other otarids known only from limb bones that have recently been discovered in the Tertiary deposits of the Pacific Coast. *Desmatophoca oregonensis*[2] from Yaquina Bay, Oregon, has much the same status, as nothing more than the skull and the lower jaw have been recorded. Both of these specimens belong to considerably older formations than the Paso Robles. No fossil walrus remains have thus far been described from the Pacific Coast of North America, and their apparent absence from Tertiary deposits of this coast has not been satisfactorily explained.

The fossil pinniped discussed in this paper has many characters in common with the genera *Eumetopias* and *Odobenus*. The humerus resembles *Odobenus* in the thinness of the external margin above the outer condyle, and the extent to which the inner condyle is produced. The presence of a large articular surface for the trochlea on the head of the radius and a well-defined tubercle are additional points in common with the walrus. The large size of the ulna, especially the distal end, shows a further approach to the odobenid type. The position of the articular surfaces on the styloid process and the extent of the radial facet on the distal end of the ulna resembles *Eumetopias* more closely than *Odobenus*. The general appearance of the humerus, with the exception of the points previously mentioned, agrees with the otarid type.

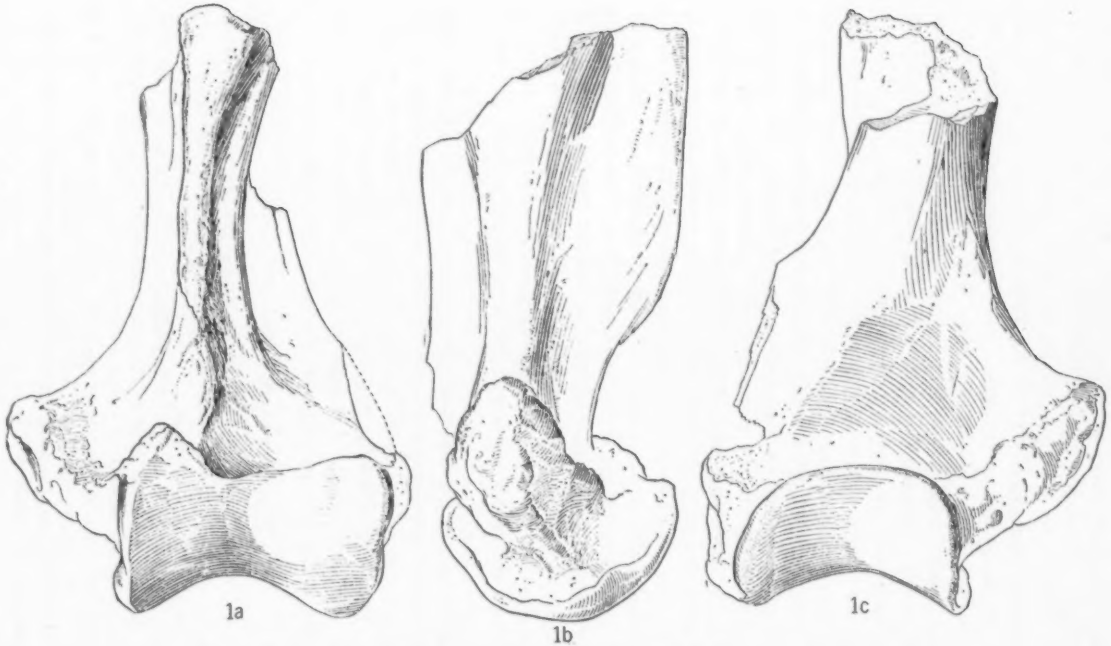
The possession of characters in common with both the Otariidæ and the Odobenidæ introduces a serious problem in the allocation of this fossil to its proper family. Moreover, since nothing is known concerning the skeleton of *Pontolis*, any determination must be regarded as more or less provisional. In consequence of these facts the writer tentatively refers this specimen to the family Otariidæ.

Pliopedia pacifica gen. et sp. nov.

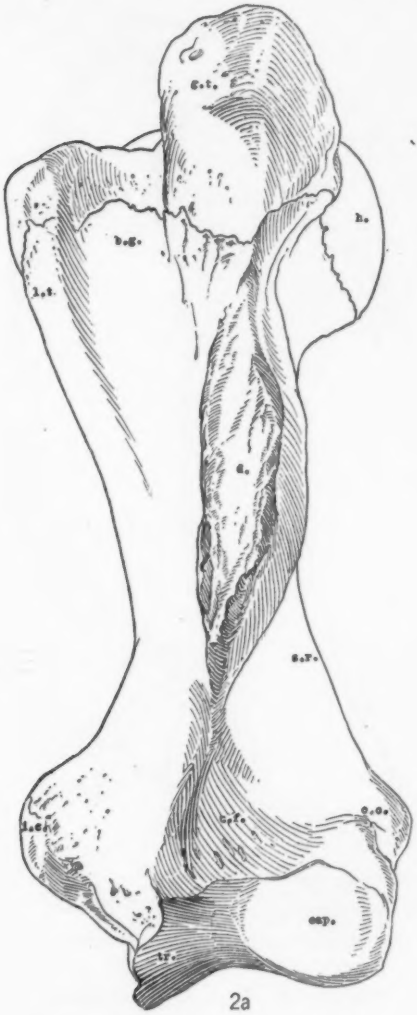
Type.—No. C. 537, Stanford University. Species based upon a number of incomplete bones including a humerus, radius, ulna, three metacarpals, two metatarsals, and three phalanges.

Locality.—In uncharted section of Township 29 South, Range 13 East (San Luis Quadrangle), on summit of hill one mile southeast of Santa Margarita,

[2] Condon, T., Univ. Oregon Bull., suppl. to vol. 3, no. 5, pp. 5–14, pls. 1–2, text figs. 1–3, Eugene, Oreg., 1906; Wortman, J. L., Science, n.s., vol. 24, no. 603, pp. 89–92, 1906; Hay, O. P., Proc. U. S. Nat. Mus., vol. 49, no. 2113, p. 383, Washington, D. C., 1915.



LEFT HUMERUS OF *Pliopedia pacifica* × ½ No. C. 537, STANFORD UNIVERSITY
Santa Margarita, California: fig. 1a, anterior view; fig. 1b, internal view; fig. 1c, posterior view.



2a

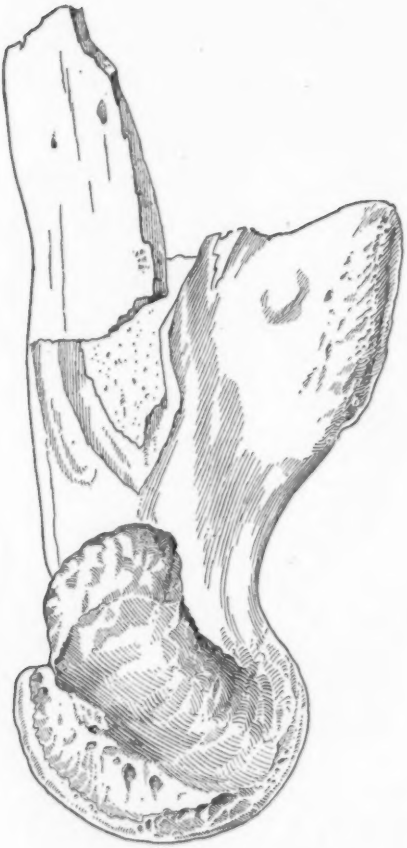
LEFT HUMERUS OF *Eumetopias jubata* × ½ No. 8821, MUS. VERT. ZOOL.

Año Nuevo Island, California: fig. 2a, anterior view. *b.g.* bicipital groove; *cap.* capitellum; *c.f.* coronoid fossa; *d.* deltoid process; *g.t.* greater tuberosity; *h.* head; *i.c.* inner condyle; *l.t.* lesser tuberosity; *o.c.* outer condyle; *s.r.* supinator ridge; *t.r.* inner trochlea.

LEFT HUMERUS OF *Eumetopias jubata* × ½, No. 8821, MUS. VERT. ZOOL. Año Nuevo Island, California: fig. 2b, internal view

LEFT HUMERUS OF *Trichecodon koninckii* × ½ (AFTER VAN BENEDEN, 1878, ATLAS, pl. 7, FIG. 1)

Antwerp basin, Belgium; fig. 3a, anterior view



LEFT HUMERUS OF *Trichecodon koninckii* × ½ (AFTER VAN BENEDEN, 1878, ATLAS, pl. 7, FIG. 2)

Antwerp basin, Belgium; fig. 3b, internal view

between Trout Creek and Yerba Buena Creek, San Luis Obispo County, California. The hill is probably the south one of the two 1,200 ft. knobs on the sheet.

Horizon.—The specimens were discovered by Robert Anderson in March, 1909, in a formation of gravel and sand overlying typical Santa Margarita beds. These beds are considered to belong to the Paso Robles formation of the Upper Pliocene.

The left humerus of this form differs very considerably from that of *Alachtherium cretsii*[3] and also from that of *Alachtherium antwerpiensis*[4] and to a less extent from that of *Trichecodon koninckii*[5] as figured by Van Beneden. Its most striking general characteristic is the antero-posterior compression of the distal end and the lateral compression of the shaft in the deltoid region.

When seen in front (fig. 1a), the shaft appears considerably narrowed at the middle, arcuate in outline externally, and flaring out suddenly internally at the distal end. The external border no doubt arose below the overhanging posterior hook of the head of the humerus, as in *Eumetopias jubata* (fig. 2a), for its superior margin is so directed while it widens out distally as the supinator ridge. The deltoid ridge is prominently developed and forms the sharp anterior edge of the shaft. The anterior margin of the deltoid crest folds over the external border of ridge in both *Eumetopias* and *Zalophus*, while in *Odobenus* the folding over is on the internal side. In *Mirounga* the deltoid ridge is low and the crest is uniformly rounded; this approximates more closely the type of deltoid ridge exhibited by this fossil humerus. However, the deltoid ridge itself curves or folds over the internal side to a slight degree in this fossil though not to such a marked extent as in *Odobenus*.

When viewed from the internal side (fig. 1b), the deltoid ridge is seen to curve prominently upward, though the antero-posterior diameter of the shaft in the deltoid region is not conspicuously wider than a lower trochlear portion, as is the condition in both *Eumetopias jubata* (fig. 2b) and *Trichecodon koninckii* (fig. 3b). This humerus resembles somewhat that of the common sea lion of the Pacific Coast, but is slightly smaller throughout than the humerus of the old male used for comparison, and a little broader at the distal end. The supinator crest is a little more flaring and sharp edged than in *Eumetopias jubata*, the trochlea is relatively wider, and the internal condyle is more produced. The external margin of the shaft is very thin and sharp edged in both *Odobenus* and this fossil. This margin is rounded in *Eumetopias* and *Zalophus* though in *Arctocephalus australis* it is slightly compressed and sharp edged.

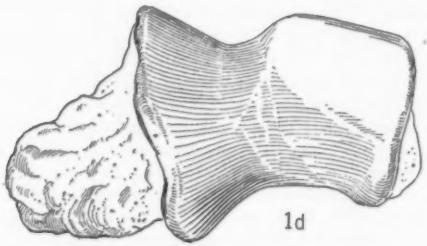
The coronoid fossa is apparently quite deep in comparison with those of *Eumetopias jubata*, *Zalophus californicus*, or *Odobenus divergens*, though the exposed surface of the humerus in this area has suffered slightly from erosion. This fossa is bordered internally by a broad rounded ridge extending up towards the lower end of the obliquely placed deltoid crest. This ridge is considerably reduced in *Odobenus divergens* and is more prominent in *Zalophus californicus*

[3] Van Beneden, P. J., Ann. Mus. Roy. Hist. Nat. Belgique, Atlas, vol. 1, pl. 3, figs. 1–2; pl. 4, fig. 1, Bruxelles, 1878.

[4] Hasse, G., Bull. Soc. Belge de Geol., de Paleon., et d'Hydrol., vol. 23, Memoires, pl. 5, figs. 1–4; pl. 6, fig. 1, Bruxelles, 1910.

[5] Van Beneden, P. J., *op. cit.*, Atlas, pl. 7, figs. 1–2.

than in *Eumetopias jubata*. The inferior face of the shaft (fig. 1c) is somewhat flattened, being slightly twisted on the long axis from the external to the internal side. The surface of the shaft is missing in the area where the olecranon fossa should occur, extending inward as far as the inferior margin of the inner condyle.

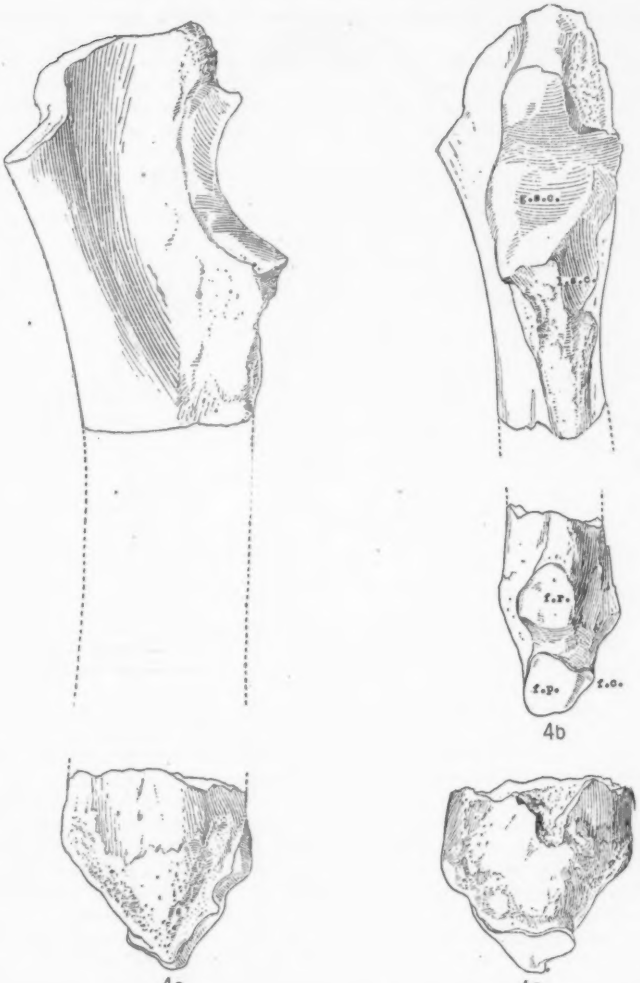


LEFT HUMERUS OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY Santa Margarita, California: fig. 1d, distal view

The trochlear surface (fig. 1d) for articulation with the bones of the forearm is divided into an outer and less convex capitellum articulating with the radius, and a trochlea articulating almost entirely with the ulna, though to some extent with the inside of the proximal facet of the radius. From an inferior view (fig. 1c.), the trochlea is observed to be convex from above downward and concave from side to side. It is limited internally, externally, and proximally by a sharp crest.

The inner condyle is a triangular tuberosity projecting internally and slightly backward; its anterior surface is a continuation of the internal surface of the shaft and is bounded medially by the coronoid fossa. The outer condyle is much less prominent than the inner. The external surface is a continuation downward of the supinator ridge. It is convex from above downward, forming a shallow crescentic concavity between its inferior margin and the rounded edge of the capitellum.

In its general form the ulna (fig. 4a) was undoubtedly much like that of *Eumetopias jubata* (fig. 5), or that of *Odobenus divergens*, but with the distal end much stouter and broader. It is very much larger than the radius, as in other pinnipeds. The olecranon process and the proximal end of the ulna beyond the semicircular greater sigmoid cavity are missing. This articular surface on the anterior face of the ulna for the trochlea of the humerus is characterised by an evenly concave curve, wider above than below; its proximo-distal diameter (fig. 4b) is proportionately greater than in *Eumetopias jubata*. Immediately below the greater sigmoid cavity and on the external face there is a shallowly concave articular surface which receives the head of the radius. Below this lesser sigmoid cavity is a small rounded tuberosity which articulates with the tubercle on the postero-internal margin of the shaft of the radius (fig. 6c). No trace of this tuberosity is observed on the ulna of *Odobenus divergens* or of *Zalophus*



LEFT ULNA OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY

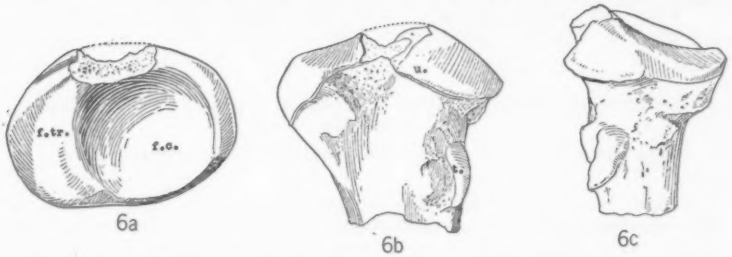
Santa Margarita, California: fig. 4a, internal view; fig. 4b, anterior view; fig. 4c, external view distal fragment. *f.c.* facet for cuneiform; *f.p.* facet for pisiform; *f.r.* facet for radius; *g.s.c.* greater sigmoid cavity; *l.s.c.* lesser sigmoid cavity.

LEFT ULNA OF *Eumetopias jubata* × ½, No. 8821, MUS. VERT. ZOOL.
Año Nuevo Island, California: fig. 5, internal view

californicus, though a very rudimentary one is found on that of *Eumetopias jubata*. The coronoid process is broken off.

The shaft of the ulna is sub-triangular in section. In the area of the greater sigmoid cavity the shaft is convex on the external face and deeply concave on the internal; the posterior margin of the shaft is twisted towards the internal side. The external face of the ulna below the greater sigmoid cavity in both *Odobenus* and *Eumetopias* is concave.

The distal end is considerably enlarged in contrast with that of *Eumetopias jubata*. The articular facets are not sharply marked off from the roughened shaft. The articular surface on the anterior border for articulation with the radius (fig. 4b) is separated from a similar surface for the pisiform by a shallow groove. This facet for the radius is slightly convex; it faces forward and slopes slightly to the internal margin. The styloid process (fig. 4c) has two articular



LEFT RADIUS OF *Pliopedia pacifica* × ½, NO. C. 537, STANFORD UNIVERSITY

Santa Margarita, California: fig. 6a, proximal view; fig. 6b, posterior view; fig. 6c, internal view. *f.c.* facet for capitellum of humerus; *f.tr.* facet for inner trochlea of humerus; *t.* tubercle; *u.* ulnar facet.

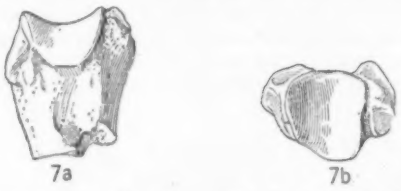
surfaces, one for the pisiform and the other for the cuneiform, the contact being oblique in both cases. Both of these articular surfaces are slightly concave.

The proximal end of the radius (fig. 6a) is suboval in shape, as in *Odobenus divergens*. The facet for the capitellum is of considerable extent and strongly concave; it slopes downward from the ulnar to the anterior margin of the head. This facet is continuous internally with the convex articular surface for the trochlea of the humerus. The trochlear facet slopes downward to the internal margin of the head of the radius. It is also continuous posteriorly with the ulnar facet. In general form the head of the radius approaches very closely that of *Odobenus divergens*, the ulnar facet (fig. 6b) being comparatively flat, permitting of but a limited degree of rotation with the lesser sigmoid cavity of the ulna. It differs from both *Eumetopias jubata* and *Zalophus californicus* in the extent of the facet for the trochlea, which is considerably reduced in these two forms.

The neck is clearly defined on all sides. The tubercle (fig. 6c) is located on the postero-internal margin of the shaft, its superior margin terminating 18 mm. below the inferior margin of the ulnar facet. Adjacent to it there is a low rugose tuberosity. The tubercle is subtriangular in outline; its greater diameter is

20 mm. and it terminates below in a bluntly pointed apex. A tubercle similar in shape is present in *Zalophus californicus*, though only a scar marks its presence on the radius of *Eumetopias jubata*. In *Odobenus divergens* the tubercle and tuberosity of the fossil are represented by a pair of flattened adjoining articular surfaces.

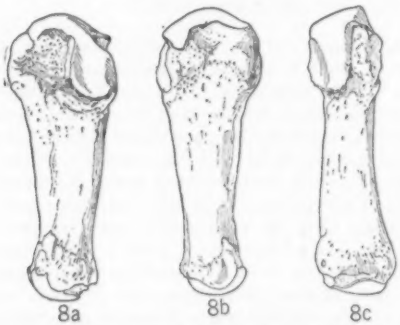
The structure of the carpus is unknown and it is hoped that future geological work in this region will result in the accumulation of additional material. The metacarpals are relatively slender and slightly enlarged at their articulations.



RIGHT METACARPAL I OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY

Santa Margarita, California: fig. 7a, dorsal view; fig. 7b, proximal view

The first metacarpal of the right fore limb (fig. 7a) differs from the others in its larger size and in the shape and direction of its proximal articular surface. Its proximal surface (fig. 7b) for articulation with the trapezium is convex from the dorsal to the palmar border and concave transversely. On the ulnar face is a concave articular surface for the corresponding facet on the head of the second. The shaft is sub-triangular in outline; immediately below the proximal facet and



LEFT METARCARPAL III ? OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY

Santa Margarita, California: fig. 8a, radial view; fig. 8b, ulnar view; fig. 8c, dorsal view.

on the dorsal face there is present a shallow depression. On the radial face of the head are two smooth surfaces; one is somewhat flattened and slopes obliquely to the palmar face; the other is slightly concave and faces proximally. The palmar face of the shaft on the proximal end is strongly concave.

The determination of the remaining four bones is very difficult, owing to the want of a complete series of the bones of either the metacarpus or the metatarsus. Moreover, the similarity of these elements to one another introduces another element of doubt when one attempts by comparison with living otarids to allocate these bones definitely. In consequence of these difficulties the following determinations of these bones must be regarded as more or less provisional.

9

RIGHT METATARSAL II ? OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY

Santa Margarita, California: fig. 9, proximal view

The best preserved of these four bones is assumed to be the third metacarpal on the left side. Its proximal surface is strongly concave from before backward. This surface is continuous with a shallowly concave facet (fig. 8a) on the radial face. On the ulnar surface of the base (fig. 8b) near the dorsal border is a concave facet for articulation with the adjoining metacarpal. This third metacarpal is somewhat expanded at the base and to a less extent at the head (fig. 8c); the shaft curves inward to a greater degree than is normal in *Eumetopias*.

10a 10b

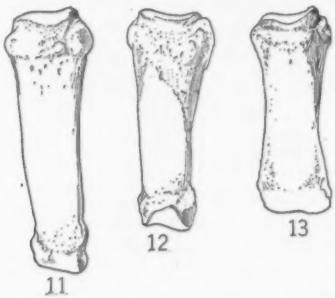
RIGHT METACARPAL IV ? OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY

Santa Margarita, California: fig. 10a, plantar view; fig. 10b, tibial view

Among these four is the base of what is considered to be the second metatarsal. Its proximal end (fig. 9) is triangular in outline; the articular surface slopes from the plantar to the dorsal border and is concave from side to side. On the tibial margin is a rounded process for the internal cuneiform, and more proximally and nearer the plantar border is a second facet for the same element.

The base of the next bone to be considered is missing, and there is nothing distinctive about the shaft (fig. 10a) to indicate its true position, though possibly it may be the fourth metacarpal. The shaft (fig. 10b) is somewhat curved from the base to the head.

The fourth bone to be discussed consists of a fragment of the base of what appears to be the fifth metatarsal but this lacks the epiphysis. It has not been figured and with the exception of the flattened triangular outline of the shaft and the long dorso-plantar diameter, there is nothing particularly distinctive about it.



PHALANGES OF *Pliopedia pacifica* × ½, No. C. 537, STANFORD UNIVERSITY

Santa Margarita, California: fig. 11, dorsal view of second phalanx; fig. 12, dorsal view of third phalanx; fig. 13, dorsal view of fourth phalanx.

The phalanges of the forefoot were apparently very similar to those of *Eumetopias jubata*, judging from the three which were collected. There is nothing remarkable or unusual about these bones, for they agree in all their principal features with those of *Eumetopias* and differ only in minor details of the facets and in the curvature of the shafts. The proximal facet on the base of the second phalanx is concave from side to side; the curvature of the shaft (fig. 11) is toward the radial side, and the facet on the head is convex from above downward. It is considerably longer than the third or fourth phalanx. The third phalanx (fig. 12) is much stouter and shorter than the second and is essentially the same as the corresponding phalanx of *Eumetopias jubata*. The fourth phalanx (fig. 13) is slightly shorter and relative stouter than the third, and the head is equal in width to the base.

Bureau of Biological Survey, Washington, D. C.

A REVIEW OF SOME RECENT WORK ON THE MAMMALIAN REPRODUCTIVE CYCLE

By George W. Corner

Workers in the physiology of reproduction, usually undertaking investigations to serve their practical needs as gynecologists or animal breeders, have found themselves under the necessity of understanding the reproductive cycles of some of the common domestic mammals, and have thus been forced to study natural history in a field but little cultivated by the faunal naturalists. In the end, however, gain may be had in both directions, for it can hardly be doubted that important evolutionary trends underlie the present extraordinary diversity of the reproductive phenomena of mammals. It will not be necessary to point out here extended illustrations of this diversity; we may briefly recall that among the ungulates alone we have such phenomena as the annual rutting of deer, in some species accompanied by violent oestrous manifestations in both sexes; in ewes an annual season of several repeated "heats;" in domesticated sows and cows a perennial cycle of about twenty-one days interval. In the laboratory rodents there appear to be perennial cycles of diverse lengths, with outward manifestations so slight that they may evade even the practised watcher; while in the catarrhine apes and man we have a perennial cycle averaging four weeks, with what might be called a dispersed oestrus, and with the additional phenomenon of menstruation. Internally the same apparent diversity reigns; mammals differ as much in their uteri as in their brains, and the comparative ovarian histologist might almost duplicate some feats of the paleontologist who names a species from a single tooth or vertebra, for it requires but little skill to distinguish all the common domestic mammals by glancing at sections of their ovaries. These histological differences concern not only mere details of architecture and of size, but also the duration of growth of the corpus luteum, the rate and type of atresia of the Graafian follicles, and the amount of interstitial tissue.

Attempts to untangle the problem have led, during recent decades, to the development of two general ideas about which current work is centering. It seems probable, first, that in all mammals the ripening of ova is a regularly periodic function accompanied by characteristic changes primarily in the ovaries and secondarily in the whole reproductive tract; and second, that these changes are continued after ovulation

in such a way that the uterus is prepared to receive and nourish the embryos which may result from the ovulation if mating occurs. It is likely that all the phenomena of the female reproductive cycle can in the end be related to these two ideas.

With regard to the first point an important step was gained by Stockard and Papanicolaou (1917) when by extending certain old and almost unnoticed observations they showed that the oestrus of the guinea-pig, outwardly so inconspicuous, is actually marked by a series of characteristic changes in the vaginal wall, so that microscopic examination of a smear of the vaginal fluid enables the observer to predict the occurrence of ovulation with accuracy. At intervals of about fifteen days there is first a desquamation of epithelial cells and then the passage of white blood cells in great numbers through the vaginal wall; if the animal is killed on the day of these changes its ovaries are found to contain ripe follicles with mature ova, and the uterine epithelium is in a characteristic state interpreted by Stockard and Papanicolaou as indicating active degeneration.

Long and Evans (1920, 1921) whose preliminary notes are about to be extended in a comprehensive monograph, have attained such accuracy with similar studies on the albino rat that they can predict the time of ovulation within one hour, and in their hands the method is already serving as a tool for the investigation of many problems of the oestrous cycle. In the white rat ovulation is very frequent (every four to six days), the interval being actually less than the time required for the passage and implantation of the fertilized ova. It will be seen that this frequency would inevitably lead to superfoetation, were it not for a special mechanism discovered by Long and Evans, namely that the act of copulation itself postpones the next ovulation for a sufficient length of time to protect the mother from a second crop of ova, until the pregnancy itself can work the usual further postponement. The mechanism by which this end is attained seems to be a reflex from the genital canal, for the mere insertion of a glass rod into the cervix uteri is as effective as a normal copulation.

Allen (1921) has worked out a similar cycle in the albino mouse; and we may now look forward to the application of such studies to some of the supposedly special cases among rodents, such as the rabbit, in which it is said that ovulation cannot be completed without copulation. No applications of this method to mammals of other orders have as yet been reported, although there is good reason to expect interesting results in this direction. However there have been several contri-

butions sharpening our knowledge of the relation between ovulation and oestrus in animals showing marked outward signs of heat, as for instance those of Longley (1912) on the cat, Lewis (1911) and Corner and Amsbaugh (1917) on the sow, and Küpfer (1920) on the cow. In all these animals oestrus is promptly followed by the development of corpora lutea in the ruptured Graafian follicles.

The second general idea outlined above has slowly grown out of the suggestion of Prenant and Born that the corpus luteum is a gland of internal secretion, serving to produce changes in the uterus and ovary. Later workers, including Fraenkel, L. Loeb, Ancel and Bouin, Hill and O'Donoghue, and others, have developed the hypothesis by assuming that the changes effected by the corpus luteum are aimed at facilitating the implantation of the embryos. The best experimental attack on the problem was made in 1907 by Leo Loeb, who found that (in the guinea-pig) when newly-formed corpora lutea are present in the ovaries, and then only, the uterine mucosa is in a specially responsive state, so that the presence of the ova, or even of an artificial foreign body, leads to the production of a decidual or placenta-like change of the uterus. In its simplest form this beautiful experiment, now several times confirmed by others, requires only that one select an animal about one week after an unfertilized ovulation, and traumatize the uterine mucosa with a needle. Four or five days later the stimulated areas are marked by the presence of swellings histologically resembling decidual tissue. Preliminary removal of the ovaries (or, according to Loeb, of the corpora lutea alone) prevents the formation of the deciduomata.

The present writer has attempted, by way of testing the foregoing considerations, to study the whole ovarian and uterine cycle in one species, and to make the supposed utility of the uterine changes for implantation of the embryos something more than a matter of hypothesis, by actually correlating the state of the uterus at every stage with the progress of the ova and embryos. For this purpose the domestic sow was chosen, because it appears to be the only mammal whose earliest embryology and mode of implantation are as yet sufficiently known and accessible to re-study which at the same time exhibits uncomplicated and outspoken oestrous phenomena.

It has been found, in brief, that the external manifestations of oestrus, which recur at intervals of about twenty-one days, are associated with a regular ovarian cycle. A day or two before the onset of oestrus a group of follicles is prepared for ovulation; they rupture

during the oestrous period, and are succeeded by corpora lutea, which reach their full development in one week, and remain in active state until the fifteenth day after ovulation, when they suddenly degenerate to make way for a new group of follicles. If the ova are not fertilized they pass into the uterus and degenerate there about the seventh or eighth day; but if fertilized they become attached to the uterine mucosa between the tenth and fifteenth days, at the very time when the corpora lutea are at their height. (In this case, of course, the corpora lutea do not degenerate, but persist throughout pregnancy.) There is also a parallel series of changes in the uterus. At oestrus the uterine mucosa is in a state like that described in the rodents by Stockard and Papaincolaou and by Long and Evans; but during the following week it undergoes marked growth changes, and during the second week (the time of implantation) still further histological modifications take place which seem clearly adapted to aid first in transporting and then in attaching the embryos. These alterations go on, however, whether or not the ova are fertilized; but if no embryos are formed, then when the corpora lutea degenerate the uterine mucosa also reverts to its original condition, and by the simultaneous occurrence of epithelial degeneration and proliferation is brought back to the oestrous stage.

Long and Evans (1921) find that in the albino rat there are characteristic changes of the vaginal mucosa during the first weeks of pregnancy. Under the conception which we have been outlining, similar changes should occur after an unfertilized ovulation, but it appears that their full development is aborted by the briefness of the cycle in this species. However, as Long and Evans have discovered, if the return of oestrus be postponed by the insertion of a glass rod into the cervix uteri, as described above, then the vagina shows changes in every way similar to those of pregnancy.

It will be apparent from the foregoing review that this branch of investigation has now reached a stage of exploration and of comparison, and that there is a pressing necessity for careful study of the reproductive habits of all accessible mammals. From the medical standpoint an especial interest attaches to the mechanism of reproduction in the primates, and it is here that the greatest service can be rendered by those who deal with wild animals at large and in captivity, by gathering together enough information to give a basis for experimental work. We have seen that this work must be founded upon specific knowledge of life-processes; at present we have little more than hearsay and travellers' tales about the reproductive cycle of the monkeys and apes.

For instance, though it is at last definitely known that the old-world monkeys undergo menstrual phenomena very similar to those of the human species, yet with regard to the new-world forms all one can learn after somewhat persistent querying is that no one has seen a menstruating platyrrhine monkey; whether these American monkeys have an annual breeding season, or bear young at all seasons of the year, does not appear in books of natural history. These questions will serve to show the importance of a field of inquiry in natural history, as yet almost unexplored, in which are to be gained results of immediate practical utility. And finally, as we hinted at the beginning, it is not beyond hope that when common laws are understood through all the diversity of form and function, light may be thrown upon some of the wider questions of mammalian evolution.

PAPERS CITED

ALLEN, E. 1921. The oestrous cycle in the mouse. Proc. Amer. Assoc. Anat., 37th Session, Anat. Rec., xxi, 43.

CORNER, G. W., AND AMSBAUGH, A. E. 1917. Proc. Amer. Assoc. Anat., 33rd Session, 1916. Anat. Rec., ii, 345.

CORNER, G. W. 1921. Cyclic changes in the ovaries and uterus of the sow, and their relation to the mechanism of implantation. Publications of the Carnegie Institution of Washington, No. 276 (Contributions to Embryology, no. 64).

KÜPFER, M. 1920. Beiträge zur Morphologie der weiblichen Geschlechtsorgane bei den Säugetieren. Denkschr. d. Schweiz. Naturf. Gesellsch., lvi.

LEWIS, L. L. 1911. The vitality of reproductive cells. Bull. No. 96, Agric. Exp. Station of Oklahoma.

LOEB, L. 1907. Ueber die experimentelle Erzeugung von Knoten von Deciduagewebe in dem Uterus des Meerschweinschens. Centralbl. f. allg. Path. xviii, 563.

LONG, J. A., AND EVANS, H. M. 1920. The oestrous cycle of the rat, etc. Proc. Amer. Assoc. Anat. 36th Session, Anatomical Record, xxi, 56.
1921. Further studies on the physiology of reproduction. Ibidem. vol. 21, 56.

LONGLEY, W. H. 1911. Maturation of the egg and ovulation in the domestic cat. Amer. Jour. Anat., xii, 139.

STOCKARD, C. R., AND PAPANICOLAOU, G. N. 1917. The existence of a typical oestrous cycle in the guinea-pig with a study of its histological and physiological changes. Amer. Jour. Anat., xxii, 225.

Anatomical Laboratory, Johns Hopkins University, Baltimore

TWO NEW RODENTS FROM OREGON AND NEVADA

By E. A. Goldman

Golden-mantled chipmunks representing the various geographic races of *Callospermophilus lateralis* (Say) occur throughout most of the higher mountains of the western United States, and outlying forms reach Canadian and Mexican territory. A readily distinguished subspecies appears to be isolated on the upper slopes of the Charleston Mountains, southern Nevada. These mountains are completely surrounded by Lower Sonoran deserts which are doubtless effective barriers limiting the distribution of this species and responsible for the differentiation noted.

This chipmunk and a heretofore undetected form of one of the rarer kangaroo rats, *Perodipus microps*, are characterized as follows:

Callospermophilus lateralis certus subsp. nov.

NEVADA GOLDEN-MANTLED CHIPMUNK

Type from Charleston Peak (north base), Charleston Mountains, Nevada. No. 208891, ♂ adult (teeth slightly worn), U. S. National Museum (Biological Survey Collection), collected by Luther J. Goldman, June 29, 1915. Original number 2270.

Distribution.—Known only from the Charleston Mountains in southern Nevada.

General characters.—Distinguished by pale general coloration in combination with dark russet under side of tail; most closely allied to *C. l. trepidus*, but ground color paler, the under side of tail however, of a dark, rich russet, instead of ochraceous-buff or ochraceous-tawny tone. Similar in color to *C. bernardinus* but paler and cranial characters distinctive.

Color (summer molt nearly complete).—Head, neck and shoulders between tawny and ochraceous-tawny, varying in intensity but tending to become paler on sides of neck and shoulders, more or less mixed with grizzled gray or presenting a patched appearance during the molt; median dorsal area grizzled grayish brown becoming darker on rump; inner black stripes broad and distinct; flanks light grayish; underparts whitish or dull grayish, the dark basal color of hairs showing through; throat and chin ochraceous-buffy in some specimens; feet dull whitish, or pale buffy; tail above mixed black and ochraceous-buff changing to grizzled grayish brown near base, below rich russet interrupted by a narrow black lateral line and ochraceous-buffy edging.

Skull.—Closely resembling that of *C. l. trepidus*, but slightly smaller and lighter, with narrower ascending branches of premaxillæ, and rather narrow basioccipital. Compared with *C. l. chrysodeirus* and *C. bernardinus* the nasals are more wedge-shaped, narrower posteriorly and nearly conterminous with premaxillæ (usually extending posteriorly well beyond premaxillæ in *chrysodeirus* and *bernardinus*).

Measurements (type).—Total length, 251; tail vertebræ, 76; hind foot, 38. An adult male topotype: 256, 80, 39. Two adult female topotypes respectively: 247–240; 79–70; 39–37. *Skull* (type): Greatest length, 42.8; zygomatic breadth, 25.9; interorbital breadth, 9.1; length of nasals, 13.5; upper molariform toothrow, 8.2.

Remarks.—In the rich russet color of the under side of the tail *C. l. certus* departs from its nearer geographic neighbors, *C. l. trepidus*, *C. l. chrysodeirus* and *C. bernardinus*. In this character it agrees closely with *C. l. castanurus*, but differs widely from the latter form in much paler general coloration, and in cranial details, especially the larger audital bullæ. Specimens from Arc Dome, Reese River (near head), Monitor Mountains, and Toyabe Mountains, Nevada are somewhat intermediate in characters between *C. l. certus* and *C. l. trepidus*, but may be assigned to the latter form.

Specimens examined.—Four, all from the type locality.

Perodipus microps preblei subsp. nov.

PREBLE'S KANGAROO RAT

Type from Narrows, Malheur Lake, Harney County, Oregon. No. 79340, ♀ adult, U. S. National Museum (Biological Survey Collection), collected by E. A. Preble, July 23, 1896. Original number 1201.

Distribution.—Plains regions of southeastern Oregon and northwestern Nevada.

General characters.—Closely allied to *P. m. microps* and *P. m. levipes* but color darker than is typical of either, and cranial characters distinctive. Differing from *P. m. levipes* in slightly smaller size.

Color (type).—Upperparts near pinkish cinnamon (Ridgway, 1912), finely and rather inconspicuously lined with black; underparts, and extent and arrangement of white and black markings about as usual in the group.

Skull.—Similar in general to those of *P. m. microps* and *P. m. levipes*, but decidedly smaller than that of the latter and differing from both as follows: Mastoid and audital bullæ smaller, the mastoids less inflated along line of contact with parietals and supraoccipital resulting in a more flattened condition of this portion of cranium; supraoccipital decidedly broader, less depressed above, and more widely separating mastoids; maxillary arches very narrow, with angle slightly developed as usual in the species.

Measurements (type).—Total length, 263; tail vertebræ, 154; hind foot, 41. An adult male topotype, 269, 158, 41. *Skull*: Length (median line), 33.5; mastoidal breadth, 22.4; breadth across maxillary arches, 19.2; least width of supraoccipital (upper surface near posterior border of interparietal), 2.5; length of nasals, 11.6; upper molariform toothrow, 4.2.

Remarks.—Specimens referred to *P. m. levipes* from various localities in California, Nevada and Utah are darker than the typical form and indicate intergradation with the geographic race here described.

Specimens examined.—Total number, 11, from localities as follows:

OREGON: Narrows (type locality), 7; Summer Lake, 1; Tumtum Lake, 2.

NEVADA: Granite Creek, Humboldt County, 1.

Biological Survey, Washington, D. C.

GENERAL NOTES

A FOX ASSOCIATING WITH MOUNTAIN SHEEP ON THE KENAI PENINSULA, ALASKA

In the fall of 1912, Morris L. Parrish and Wilson Potter, both well known sportsmen in Philadelphia, made a hunting trip to the Kenai Peninsula, Alaska. In a sumptious folio volume Mr. Parrish privately published his diary of this trip and illustrated it with two hundred and nine photographs. The title is: "Hunting on The Kenai Peninsula A Daily Diary Illustrated with Some Photographs By Morris L. Parrish, Philadelphia, Pa.; 1913. Privately Printed." This is an extremely interesting record of the trip and the game. Since but few copies were issued and therefore the observations recorded will never be easily available to naturalists, it seems worth while to record in the Journal of Mammalogy an unusual sight witnessed by Mr. Parrish and his guide, H. E. Revell, who was indicated as the "Colonel."

In the mountains about the divide between Tustamena Lake and the Kenai River, Mr. Parrish on the date mentioned killed a ram. The following quotation follows this event: "September 18, 1912. . . . . We went right on thinking there might be some more sheep in a gulch further down, and here we saw what the Colonel said was a most remarkable and un-heard-of sight. Three rams were on the side of a hill, walking along in single file, and a cross fox was walking with them, he jumping up and biting their faces in play, and they butting him gently along in front. When they lay down he lay down too, and they were evidently travelling together, and the best of friends. We watched them for fully 15 minutes through the glasses at about 300 yards. There was another ridge, some 200 yards further on, and we crawled along this, but when we reached it the rams had disappeared. We saw the fox some distance off, but could not find the sheep again. . . . ."—CHARLES SHELDON, *Washington, D. C.*

A WOLVERINE IN A TREE

In connection with the recent notes by Dr. George Bird Grinnell on the ability of the wolverine to climb trees I would like to call attention to a photograph of one in a tree which was published in the National Geographic Magazine, vol. 29, May, 1908, p. 353. The picture was taken in October, 1907, in Big Horn County, Wyoming, by Alan D. Wilson, who says: "The photo is I think almost unique for they are not only rare, but generally prefer to go over the rimrock than tree when chased."—N. A. WOOD, *Museum of Zoology, University of Michigan, Ann Arbor, Mich.*

A MONGOOSE IN KENTUCKY

On December 20, 1920, a mammal received for identification by the United States National Museum, during the absence of Mr. Gerrit S. Miller, Jr., curator of mammals, was referred to me for determination. The specimen consisted of a cased skin, with the feet, tail, and anterior portion of the snout attached, including most of the maxillary and mandibular teeth. It was an adult mongoose, *Herpestes griseus* E. Geoffroy. The animal had been trapped by Mr. Thomas May, November 18, 1920, in a field just on the edge of the village of Midway,

Woodford County, Kentucky. Mr. May noticed that something had been running under a haystack, and, thinking it might be a mink, he set a trap under the stack and caught the mongoose,—an animal entirely strange to him and to other people of the vicinity. No record of how the mongoose reached the region can be traced.

This animal, *Herpestes griseus*, a native of India, is the same species which has been introduced into Cuba, Porto Rico, and several other places, for the destruction of noxious rodents, but it has become a serious pest on account of its destruction of poultry and birds. The capture of a single animal in the United States should not in itself unnecessarily alarm us, but it should stimulate us to be doubly on our guard. In spite of laws, ably administered and rigidly enforced, against importation or shipment of the mongoose in this country there is always a possibility that the animal might become established. Should such ever be the case it would spell the doom of all ground-nesting birds throughout a great part of the United States. Everybody interested in conservation of native wild-life should be able to recognize the mongoose and should report any occurrence of the animal in the country at once to the U. S. Biological Survey. The animal is really quite unlike any native North American species and is easily identified. It is a carnivore about the size of the mink and of similar proportions. The tail, however is rather longer than that of the mink, and tends to taper toward the tip. The animal is furred rather scantily, particularly ventrally, with a coarse, hispid hair. Its general tone of color is yellowish gray, distinctly flecked or grizzled with brownish black and whitish. This color effect is produced by an underfur of clay color intermixed with the longer guard hairs each one of which is banded alternately with fuscous-black and buffy white, the fuscous-black bands being the longer.—Hartley H. T. Jackson, *U. S. Biological Survey, Washington, D. C.*

PRIBILOF FUR SEAL ON THE OREGON COAST

On February 1, 1921, an immature male Pribilof fur seal (*Callorhinus alascanus* Jordan and Clark) in a badly emaciated condition came ashore on the ocean beach about a mile north of the bar at Netarts Bay, Tillamook County, Oregon. When first seen by a local resident the seal was high up on the dry sand, above normal high tide, and was "quite active." About two hours later, when Mr. Clarence Edner of Netarts went to look for it, he found it lying dead in the wet sand just above the breakers. Mr. Edner thinks that after the animal was first seen it made an attempt to return to the sea but died before reaching the water.

So far as I am aware, this is the only authentic record in recent years of the occurrence of the Pribilof fur seal on the Oregon coast.—Stanley G. Jewett, *Portland, Oregon.*

ELEPHANT SEALS OFF THE COAST OF CALIFORNIA

In the May number of the Journal of Mammalogy, page 112, there appeared an article by A. W. Anthony recording the appearance of elephant seals off the southwest coast of California. Several years ago Capt. Chas. Davis captured several young elephant seals on Guadalupe Island and brought them, alive, to

Venice, California, where they were exhibited in a tank of water for a year or two. The tank was on a pier extending out into the ocean.

A year or two ago a heavy storm demolished that portion of the pier where the seals were exhibited and they escaped into the ocean. It is quite probable that these animals, or some of them at least, are still living in the waters off southwestern California. No elephant seals have been heard of in this vicinity for many years. The nearest rookery is Guadalupe Island and it seems more natural to believe that the specimens recently reported are escaped animals rather than ones that have left the herd at Guadalupe and wandered north.—JOHN ROWLEY, *Los Angeles Museum, Los Angeles, California.*

MUSKRATS IN CENTRAL EUROPE

In 1906 Princess Colloredo-Mannsfeld imported four pairs of muskrats (*Fiber zibethicus*) from America and turned them loose in Dobrisch, an estate southwest of Prague, Bohemia. These animals subsequently increased in such numbers that at present they have spread all over Bohemia, into Upper and Lower Austria and Moravia and also into Bavaria and Saxony, following the watercourses.

The muskrats have shown themselves to be very injurious, as they construct their burrows in the dams and embankments of the rivers and ponds, and thus, by undermining the banks they endanger the whole system of waterways, subjecting the surrounding fields to the danger of floods.

Very strict regulations have been issued, therefore, in all the countries invaded by the muskrat, to curtail its further spread, and it is generally forbidden under heavy fines to maintain the animals, breed them, or turn them loose. All persons, directly or indirectly interested, are required to report every appearance of muskrats to the authorities. Owing to his secretive habits of life, the muskrat often succeeds in remaining unnoticed for a considerable period in his new haunts.

The muskrat is inclined to be nocturnal, but in districts where he feels himself unnoticed he is to be seen during the day also. In general it has been observed that during overcast weather and dark nights the rats do not appear for days at a time, and rarely swim about when it is windy. The muskrat builds his summer-dwelling in the high banks or dams of water courses and ponds. This consists of a burrow from which a carefully concealed exit leads to the bank, often 10 to 15 feet away; other runways lead under the water level and to the bottom of the water. Piles of earth which have been removed from the ponds are also used.

The animals established in Europe breed twice or three times a year and produce 6 or 8 young at a time. Thus an annual family of 18 to 24 young may be expected which sufficiently explains the phenomenal spreading of the species.

In winter the muskrats often abandon their burrows and build so called "winter-castles" in shallow places in the ponds. These consist of heaps of bitten off reeds, rushes or sedges, more or less mixed with mud. They have a diameter of 3 to 6 feet, project 2 to 3 feet above water level, and have no visible exits. These quarters contain a dry sleeping-place above water level and, connected with it, a burrow extending into the water.

As to the damage caused by the muskrat to fish and game the opinions vary greatly, some saying it is inappreciable, others that it is very great. As a matter of fact our animal feeds chiefly upon plants; he is even said to enter fields of grain and cut down the stalks. If plants are sufficiently plentiful he sticks to them, but if not he robs the nests of wild water-birds, even hen-yards and store houses. At any rate it is not surprising that when he has chosen a well stocked fish-pond for his headquarters he should take to catching and eating fish. In Bohemia, the centre of activity of the muskrat in Europe, there is a very extensive fisheries industry, based upon fish which are maintained in more or less artificial ponds.

I shall refrain from discussing the natural history, the general appearance or other peculiarities of the introduced muskrat, as those of his American ancestor are well known. I only intended showing how some imported animals will thrive, if adapted to their new surroundings.—THEODOR G. AHRENS, *Berlin, Germany.*

MALFORMED HIND FOOT OF THE COMMON HOUSE MOUSE (MUS MUSCULUS)

I recently captured a house mouse possessing a hind foot with six toes, instead of the usual five. The toe representing the thumb is a trifle undersize, while the superfluous member is overgrown, and protrudes awkwardly at a sharp angle from the foot. The foot itself and the remaining toes are in every way normal. I trapped this animal near Guelph on March 29, 1921, in the heart of a low, wet, and dense swamp of cedars, balsam, aspen, willow, etc. The ground in many places was carpeted with moss a half-inch or more in thickness—just such a place as one might be certain of taking the red-backed vole if it were farther north. I was somewhat surprised to find a house mouse here, having never before trapped this domestic pest under conditions of this kind, and so far removed from buildings. Doubtless it indulges occasionally in protracted wanderings, bringing up finally in some barn or house.—J. DEWEY SOPER, *Guelph, Ontario.*

NOTES ON NAPÆOZAPUS

This rare mouse has long been a subject of thought to me, and in early August of 1920 I made a trip of some hundreds of miles for the the express purpose of seeking it, but failed. What was my surprise, then, to find two in my traps on the morning of August 23, at Canoe Lake, Algonquin Park, Ontario. Subsequent nights yielded one, three and one, and then a blank, as though the supply were exhausted. Two of these fell to the traps of Stuart Thompson, of Toronto, but all the success was in a very limited area. I had been expecting to find them in deep, dark evergreens, near water, but these were captured in a small clump of alder and willow on the bank of a beaver stream. Careful examination had showed what seemed to be a runway on the dead leaves covering the ground, and the trap set on that runway yielded a mouse every night until the last, when trap and all vanished. A mink, perhaps. Further search revealed a little pile of the scales of alder fruit, and a trap set at that place by Mr. Thompson caught a mouse the next night, and near it was an alder cone partly eaten. Whether the animal is partially arboreal—totally unexpected, if true—could only be

guessed at, as we had only the one piece of evidence, but numerous traps spread out in other places than this alder thicket with one exception, yielded nothing. This was across the stream, perhaps 80 feet away, where the beaver had worn a path through the sod in climbing up a steep bank. About 5 feet up the bare path ceased, and under the overhanging sod were two mouse holes. One was right in the center of the path and there was no possible chance but that the beaver would spring any trap set there before the mouse got into it, but the other hole was at one side, and there I made a little shelf with my knife and set the trap which caught a *Napæozapus* the next morning. Further trapping at this point was fruitless, but the holes looked good, even when we left. In view of this little insight into the habits of this species I should feel rather confident of trapping it in alder thickets along beaver streams when the fruit of the alders was ready to eat.

The beautiful colors of these mice faded rapidly, and when the last one was caught Mr. F. W. Fraser kindly gave me a painting of the fresh specimen in accurate colors. An interesting feature of this new acquaintance is the instant identification by means of the size, color, and tail. Often have I tried to study a *hudsonius* into an *insignis* in vain; but when *insignis* was taken, there was never a doubt, nor any need to turn to a description. I should say that *insignis* weighs 50 to 100 per cent more than *hudsonius;* the colors, similar in the museum specimen, are much more vivid, and the tail is so much heavier at the base, as to be an immediate mark of recognition.—W. E. Saunders, *London, Ontario.*

AN INQUISITIVE PORCUPINE

Just at dusk on the evening of June 12, 1919, I caught sight of an adult porcupine (*Erethizon dorsatum*) coming along a road through heavy timber in the Penokee Range, 8 miles southwest of Mellen, Wisconsin. I remained standing still. He approached in his slow, deliberate way, absolutely unaware of my presence. The air was calm, there being no detectable breeze. At a distance of about 20 feet from me the animal stopped, looked up and around in different directions, and sniffed the air. He evidently was either rather suspicious or detected the odor of food. But he remained there only a second or two, then continued to within 15 feet, again stopped, looked directly at me, and sniffed for nearly 2 minutes, his nose in the air toward me all the while. Meantime I withstood scores of biting mosquitoes and remained perfectly silent. After "sizing up" the situation, so to speak, the porcupine changed his course an angle of 45 degrees and came directly toward me. I remained silent until he began gnawing my leather putees, when I thought it time to protest, so I made a slight movement, and "porkie" scampered away and hid among the logs and brush by the roadside.—Hartley H. T. Jackson, *U. S. Biological Survey, Washington, D. C.*

GRAYSQUIRRELS AND NUTS

At the National Zoological Park in Washington on January 23 last, I saw a graysquirrel burying a nut. It is commonly supposed that this instinct is active only in autumn. Can any one give observations to show that it is operative the

year round when food is sufficiently plentiful?—Ernest Thompson Seton, *Greenwich, Conn.*

FORMER RANGE OF MOUNTAIN SHEEP IN NORTHERN CALIFORNIA

Recent references to the occurrence of mountain sheep in northern California appear to be restricted to Mount Shasta and the adjacent Sheep Rock, a locality only a few miles north of the great mountain. The present Sheep Rock however is very different from the Sheep Rock of the early gold-seekers. The latter, as shown by George Gibbs in his Journal and accompanying map of the McKee Expedition of 1851, was situated on the *west* side of Scott Mountains, a range to the west of Shasta Valley, which it separates from Scott Valley. The Sheep Rock of 1851 is a prominent landmark as seen from Scott Valley, and is now known both locally and on the maps of the Geological Survey as Skookum Rock. It was inhabited by Sheep in Gibbs' time—how much later we do not know.

The Shaste Indians tell me that sheep formerly occurred on Goose Nest Mountain and on Bogus Mountain north of Goose Nest Mountain, and also in the Siskiyous, but just how far west they ranged in the Siskiyous I have not been able to ascertain. In 1888 I saw in a hardware store in Portland, Oregon, a mounted ram of large size killed in the Siskiyous by the proprietor of the store.

It would be interesting to know whether the big horn of these elevated mountains—Mount Shasta, Scott Mountains, Goose Nest Mountain, Bogus Mountain, and the Siskiyous—was the same species as the one formerly inhabiting the Modok Lava Beds in the northeastern corner of California.—C. Hart Merriam, *Washington, D. C.*

TWO MAMMALS NEW FOR OHIO

On February 2, 1921, Mr. Franklin Grothaus, a young farmer of my parish, brought me a fine ♂ of *Mustela cicognani*. For years the state of Ohio has been searched for this species, but the fact that the closest point to Ohio where it had been taken was in Pennsylvania, about 600 miles from here, and in Michigan, about 500 miles to the north, made it unlikely that it ever would be found. It is with pleasure that I record this new species for the state of Ohio. Measurements: length, 268 mm.; tail, 67 mm.; h. f., 30 mm. The specimen is now in my collection.

The other species new for Ohio, one that has been diligently looked for, as all the old records turned out to be something else, is *Microtus ochrogaster*, of which I have 3 specimens up to date, all taken by Mr. Hy. Ruese, a farmer of my parish living in Shelby County, Ohio, 2½ miles east of New Bremen. The first one, a ♀ taken February 15, 1921, measured: length, 131 mm.; tail, 21 mm.; h. f., 17.5 mm.; mammæ 6, foetuses 4. The second one, taken February 22, 1921, a ♂, measured: length, 126 mm.; tail, 20 mm.; h. f., 17 mm. Four weeks of trapping did not yield any results till on April 5 another ♀ was caught, measuring 130 mm. in length; tail, 19 mm.; h. f., 17 mm.; mammæ 6, foetuses 0. Thus it seems to be that the species is very rare here and probably reaches its easternmost point of distribution.—W. F. Henninger, *New Bremen, Ohio.*

WILD LIFE AND THE MOTOR CAR

On November 7, 1920, I motored from Austin to San Antonio, Texas, some 82 miles. On the road, evidently killed by motors travelling by night, were 4 cottontails, 2 dogs, 2 rats, 1 opossum, and 1 very large skunk. It is remarkable that the cottontail commonly suffers more than any other game animal from motor cars.—ERNEST THOMPSON SETON, *Greenwich, Conn.*

RECENT LITERATURE

Winge, Herluf. A REVIEW OF THE INTERRELATIONSHIPS OF THE CETACEA. Smithsonian Misc. Coll., vol. 72, no. 8, 97 pp., 1921. [Translated by Gerrit S. Miller, Jr., from Vidensk. Medd. fra Dansk naturh. Foren., Copenhagen, vol. 70, p. 59–152, 1918.]

The paper here translated is one of a series of studies by Doctor Winge on the orders of mammals. It commences with a brief statement of the supposed derivation of the group and an account of the more obvious ways in which the structure of cetaceans departs from that of land mammals as a result of a wholly aquatic existence. Following this, the major groups of the order are taken up in sequence, their chief characters are enumerated, and an attempt is made to trace a possible line of evolution for them.

The earliest known cetaceans appear in the Eocene, already equipped for living wholly in the water. They include several genera of zeuglodonts, and while some of these—*Basilosaurus* (*"Zeuglodon"*)—had already reached the height of their development, there still survived at least one member of the group so primitive that the dentition is nearly unchanged from that of one of the creodonts (*Hyænodon*). This primitive genus—*Protocetus* from the Eocene of Egypt—is accepted by Winge as in the direct ancestory of the group which he calls Zeuglodontidæ, though others including its discoverer are not convinced that these are true cetaceans.

At the conclusion of the first half of the paper (p. 45) the author sums up his views. He recognizes six families of Cetacea, all of which however are not of equivalent value, namely: (1) the "Zeuglodontidæ" (= Basilosauridæ) to include these Eocene genera which he considers are unquestionably primitive cetaceans, and "must have made their appearance somewhere within the territory occupied by the hyænodonts, and probably in the oldest part of the territory." (2) The Balænidæ, in which he includes all whalebone whales, and believes them to be derived "from the more primitive genera" of zeuglodonts, a view at variance with that of Abel, who believes the Miocene *Patriocetus* offers a connecting link between toothed and baleen species. Gregory also suggests the comparatively recent origin of the group. (3) The Squalodontidæ, whose members he would have spring "from the most primitive, tooth-bearing balænids," a view for which it is difficult to see any satisfactory basis. Both True and Abel agree in placing the Oligocene *Agorophius* (for which Abel makes a separate family) as a near ancestor of the squalodonts. (4) The Platanistidæ, considered "the descendants of the primitive squalodonts." Here are included the four living genera *Steno-*

delphis, *Lipotes*, *Inia*, and *Platanista*, long-beaked river-dolphins. The combination of characters exhibited by at least three of these genera has made their classification a matter of much controversy. While at variance with the latest views of Abel and of True, there is much to commend the close association of the other genera named with *Platanista* instead of making a special family for them. True's final conclusion, however, was that *Stenodelphis* might best be included as a member of the Delphinidæ. (5) The Delphinidæ, which Winge believes to have branched off early in the Tertiary, from "primitive platanistids." The family is a somewhat heterogeneous assemblage, and its final constitution is still unsettled. (6) The Physeteridæ, including the ziphioids as a subfamily, which are supposed by Winge to have "originated from the most primitive delphinids" during early Tertiary time, but as no members of the latter group are known before the Miocene, it is not clear what the ancestry would be like.

Although it must be confessed that the brief arguments for these "derivations" are not in all cases very convincing, yet the discussion brings out the fact of a general similarity in fundamental structure throughout the order, so that, although there is as yet no unanimity of opinion as to the precise relationships of many known genera, it does seem possible to perceive how some of the special peculiarities of various groups may have been evolved. An important section of the paper is contained in the second part—Notes,—which, besides brief discussion of controversial points, contains references to the more important literature on the order.

The translation has been done with care, even to the reproduction of the author's emendations (*e.g.*, *Rhachionectes* for *Rhachianectes*, *Xiphius* for *Ziphius*, etc.), and with a view to giving "the author's ideas as clearly and exactly as possible rather than to make smooth English sentences." Much credit is due the translator for making this important summary now readily available in English.

—*Glover M. Allen.*

Osgood, Wilfred H. A Monographic Study of the American Marsupial, Cænolestes. Field Mus. Nat. Hist., Zoöl. Ser., vol. 14, no. 1, pp. 1–162; 22 plates. May, 1921.

The curious South American marsupial *Cænolestes* has been the subject of much discussion, and has been placed in three different suborders by various workers who have dealt with its systematic position. Osgoods' extended descriptive account of its anatomy, and the conclusions based on his researches are, therefore, of great interest to all technical mammalogists.

The introductory sections include the general history of *Cænolestes* from its discovery in 1860 up to the present time, what little is known of its habits, and an account of its external characters. Following this, in the main body of the work, are detailed descriptions of the myology (pp. 22–61), urogenital system, alimentary canal, glands, respiratory and circulatory systems (pp. 61–77), skeleton and teeth (pp. 77–128). Additional chapters of special interest are: The origin or diprotodonty, relationships of *Wynyardia*, relationships of *Myrmecobioides*, phylogeny and taxonomy, and dispersal of marsupials. These all show the intensive study, clear reasoning, and fair presentation of the subject that we have learned to expect in the author's publications. A diagram of the phylogenetic

and taxonomic relationships of the principal groups of marsupials accompanies the discussion.

The essential points in Doctor Osgood's carefully prepared summary of his studies of *Cænolestes*, briefly stated, are: 1. *Cænolestes* is a surviving member of an ancient group and retains many primitive characters. 2. It has numerous resemblances to modern peramelids. 3. It has few non-marsupial characters and no great degree of specialization. 4. It has no especial affinity to the American Didelphiidæ. 5. The ancestor of the cænolestids was probably a northern form which had already separated from the generalized polyprotodont stock. 6. The North American ancestor of the cænolestids possibly extended throughout Holarctica and therefore may also have given rise to the Australian diprotodonts. 7. The phylogenetic and morphological relations of *Cænolestes* are best expressed by classifying it in the suborder Diprotodontia, family Palæothentidæ, subfamily Cænolestinæ.

The text closes with six pages on the brain of *Cænolestes obscurus*, by Dr. C. Judson Herrick, professor of neurology, University of Chicago. The figures in the plates are well executed (the line drawings of muscles and soft parts are credited to R. E. Snodgrass, a sufficient guarantee of accuracy), and each plate is faced by a lettered reference page so that, in using the work, it is unnecessary to search constantly for a special "explanation of plates." There is, unfortunately, no index.

—*N. Hollister.*

King, Helen Dean. A Comparative Study of the Birth Mortality in the Albino Rat and in Man. Anat. Record, vol. 20, pp. 321–354. March 20, 1921.

A summary of the results of Doctor King's valuable experiments shows that during a period of 5 years in a total of 31,670 newborn albino rats 415, or 1.3 per cent, were stillborn. Under normal environmental conditions not more than 2 per cent of rat fetuses are dead at birth. Normal birth mortality in man is about 4 per cent. There are no data regarding percentage of stillbirths in other mammals. The normal sex ratio in newborn albino rats, including stillborn, is about 107 males to 100 females. The average in man is about 108 males to 100 females. Doctor King found an excess of males among stillborn in rats, the ratio being 129.3 males to 100 females. Sex ratio among stillborn children is about 130 to 140 boys to 100 girls. In the rat the percentage of stillbirths seems to vary somewhat with the seasons, being greatest in the autumn and least in the spring. It appears that malnutrition is directly responsible for most of the stillbirths.

—*Hartley H. T. Jackson.*

Johnston, T. B. The Ileo-caecal Region of Callicebus personatus, with some Observations on the Morphology of the Mammalian Caecum. Journ. Anat. (London), vol. 54, part I, pp. 66–78. 1919.

These studies are based chiefly on the Brazilian mammals *Callicebus personatus*, *Dasypus sexcinctus*, *Tatusia novemcincta*, and *Cyclothurus didactylus*. In *Callicebus* the caecum is an actively functioning part of the alimentary canal. The paired lateral caeca of *Dasypus sextinctus* and *D. villosus* are regarded as the

extremities of a bifid caecum, but those of *Cyclothurus* are new formations which do not correspond to the morphological caecum. The primitive mammalian caecum was an asymmetrical structure derived from the anti-mesenteric border of the colon.

—*A. H. Schultz.*

Nomai, J. Das Stimmorgan der Primaten. Anatom. Hefte, vol. 59, 1. Abt., pp. 257–292. 1920.

This study shows the generally high development of the larynx in primates. The laryngeal cartilages in monkeys and apes resemble closely those structures in man, but the vocal lips are quite different. The arytaenoid cartilages are slender and delicate when compared with those of lemurs and all other mammals.

—*A. H. Schultz.*

Doflein, F. Die Fortpflanzung, die Schwangerschaft und das Gebären der Säugetiere. Jena, 70 pp. 1920.

A richly illustrated good review of our knowledge of fertilization, implantation, placentation, pregnancy, and birth in mammals. The paper contains no actually new facts but constitutes a new presentation and welcome collection of widely scattered data.

—*A. H. Schultz.*

Asomi, Goichi. Observations on the follicular atresia in the rabbit ovary. Anat. Rec., vol. 18, no. 4, pp. 323–343. May 20 (June), 1920.

Baldwin, Francis Marsh. Notes on the branches of the aorta (arcus aortae) and the subclavian artery of the rabbit. Anat. Rec., vol. 19, pp. 173–183, 11 figs. July 20, 1920.

Black, Davidson. Studies on endocranial anatomy. II. On the endocranial anatomy of Oreodon (Merycoidodon). Journ. Comp. Neurology, vol. 32, pp. 271–327, 48 figs. December, 1920. (Concludes that *Oreodon* was a primitive artiodactyl, presenting a curious blending of suilline and ruminant characters; any edentate resemblances are of a superficial nature.)

Burrell, Harry. Preliminary note on the breeding of *Ornithorhynchus* in 1920. Australian Zool., vol. 2, pt. 2, pp. 20–23, 2 plates. April 11, 1921. (Of the 11 nests studied, 6 contained eggs and 5 contained young; the number of eggs ranges from 1 to 3.)

Cadwalder, Williams B. Forty-ninth annual report of the Board of Directors of the Zoological Society of Philadelphia. Pp. 1–50. 1921. (Includes report of Dr. Herbert Fox, pathologist.)

Cooper, A. R. A case of the inferior vena cava uniting with the azygos vein in the dog. Anat. Rec., vol. 17, pp. 299–306, 2 figs. January 20 (February), 1920.

Dreyer, W. Vejleder i Zoologisk Have. Pp. 1–72, many figs. Kjöbenhavn, 1921. (Guide to the Copenhagen zoological gardens.)

Gillespie, T. H. Annual report of the Zoological Society of Scotland for the year ending 31st March 1921. Pp. 1–20, 8 plates. 1921.

HAAGNER, ALWIN. South African mammals. A short manual for the use of field naturalists, sportsmen and travellers. Pp. i–xx; 1–248; many illustrations. London; H. F. & G. Witherby. 1920.

——— National zoological gardens of South Africa, Pretoria. Report for the years 1919–1920. 23 pp. 1921.

HANSON, FRANK BLAIR. The development of the sternum in Sus scrofa. Anat. Rec., vol. 17, pp. 1–23, 19 figs. September 20, 1919.

——— The development of the shoulder-girdle of Sus scrofa. Anat. Rec., vol. 18, no. 1, pp. 1–21. February 20 (March), 1920.

——— The problem of the coracoid. Anat. Rec., vol. 19, pp. 327–345, 7 figs. November 20, 1920.

HARKIN, J. B. Report of the commissioner of Dominion parks for the year ending March 31, 1920. Pp. 1–53, numerous half-tones. Ottawa, 1921. (Reports a general increase in game mammals in all reservations.)

HERRICK, C. JUDSON. The brain of Cænolestes obscurus. Field Mus. Nat. Hist., Zoöl. Ser., vol. 14, no. 1., pp. 157–162; pls. 21–22. May, 1921.

HINTON, MARTIN A. C. A new bank-vole from Esthonia. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 128–129. July, 1921. (Describes *Evotomys glareolus reinwaldti*, subsp. nov.)

——— The klipspringers of Rhodesia, Angola, and northern Nigeria. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 129–133. July, 1921. (New: *Oreotragus oreotragus centralis*, Rhodesia; *O. o. tyleri*, Angola; and *O. o. hyatti*, Nigeria.)

HOLLISTER, N. A new name for the West African pygmy squirrel. Proc. Biol. Soc. Washington, vol. 34, p. 135. June 30, 1921. (*Myosciurus minutulus* for *Sciurus minutus* Du Chaillu, preoccupied.)

HORNADAY, WILLIAM T. The fur trade and wild animals. Wisconsin Conservationist, vol. 3, no. 2, pp. 5–6. May, 1921. (Considers fur-bearing animals in danger of extermination, but believes that there is yet hope of saving a remnant of them.)

HUNTINGTON, GEORGE S. The morphology of the pulmonary artery in the Mammalia. Anat. Rec., vol. 17, pp. 165–201, 7 figs (5 colored). December 20, 1919 (January, 1920).

HUNTINGTON, GEORGE S., AND CHARLES F. W. MCCLURE. The development of the veins in the domestic cat (*Felis domestica*) with especial reference, (1) to the share taken by the supracardinal veins in the development of the postcava and azygos veins and (2) to the interpretation of the variant conditions of the postcava and its tributaries, as found in the adult. Anat. Rec., vol. 20, pp. 1–30, 12 figs. in colors. December 20, 1920.

KERSHAW, P. S. On the collection of South African mammals in the Durban Museum. Ann. Durban Mus., vol. 3, pt. 1, pp. 27–38. January 31, 1921. (New: *Pachyura chriseos* and *Sylvisorex gemmeus sheppardi*.)

KITTELSON, JOHN A. Effects of inanition and refeeding upon the growth of the kidney of the albino rat. Anat. Rec., vol. 17, pp. 281–295. January 20 (February), 1920.

KLOSS, C. BODEN. Two new *Leggada* mice from Siam. Journ. Nat. Hist. Soc. Siam, vol. 4, pp. 59–63. March, 1921. (Key to Indochinese genera of *Mus*-like rodents. New species and subspecies: *Leggada pahari gairdneri* and *L. rahengis*, both from Me Taw, western Siam.)

KLOSS, C. BODEN. On *Rattus blythi* Kloss (*Mus cinnamomeus* Blyth). With remarks on allied forms. Journ. Nat. Hist. Soc. Siam, vol. 4, pp. 65–69. March, 1921.

——— A new giant squirrel from Pulo Condore. Journ. Nat. Hist. Soc. Siam, vol. 4, pp. 71–72. March, 1921. (Describes *Ratufa melanopepla condorensis*.)

——— The Pulo Condore group and its mammals. Journ. Nat. Hist. Soc. Siam, vol. 4, pp. 73–83. March, 1921. (List of 9 species of mammals, with critical notes.)

——— On a small collection of mammals from Cambodia. Journ. Nat. Hist. Soc. Siam, vol. 4, pp. 99–102. March, 1921. (New: *Tamiops macclellandi dolphoides*, from southwestern Cambodia.)

——— Two new races of Sciurus finlaysoni. Journ. Nat. Hist. Soc. Siam, vol. 4, pp. 103–104. March, 1921. (Describes *S. f. prachin*, Krabin, Central Siam, and *S. f. rajasima*, Lat Bua Kao, Eastern Siam.)

——— A habitat of Schomburgk's deer (*Cervus schomburgki*). Journ. Nat. Hist. Soc. Siam, vol. 4, p. 105. March, 1921.

——— Malaysian bearded pigs. Journ. Straits Branch, Royal Asiatic Soc., no. 83, pp. 147–150. April, 1921. (Remarks on *Sus barbatus*, *Sus oi*, and other wild pigs of Borneo and Sumatra.)

——— A new squirrel from North Sarawak. Journ. Straits Branch, Royal Asiatic Soc., no. 83, pp. 151–152. April, 1921. (*Sciurus adamsi*, sp. nov., Long Mujan, North Sarawak, Borneo.)

KOLMER, W. Über die Tastorgane von *Elephas indicus*. Anat. Anz., vol. 54, no. 5, pp. 73–77. May 22, 1921.

KRAATZ, WALTER C. A preliminary general survey of the macrofauna of Mirror Lake on the Ohio State University campus. Ohio Journ. Sci., vol. 21, no. 5, pp. 137–184. March, 1921. (Mentions occurrence of muskrat and Norway rat.)

KUNTZ, ALBERT. The inervation of the gonads in the dog. Anat. Rec., vol. 17, pp. 203–219, 4 figs. December 20, 1919 (January, 1920).

——— Experimental degeneration in the testis of the dog. Anat. Rec., vol. 17, pp. 221–234, 4 figs. December 20, 1919 (January, 1920).

LÖNNBERG, EINAR. A second contribution to the mammalogy of Ecuador with some remarks on Cænolestes. Arkiv f. Zool., vol. 14, no. 4, pp. 1–104, 1 plate and 8 text figs. 1921. (New: *Nasua gualeae*, *Dactylomys dactylinus modestus*, *Myoprocta exilis parva*, *Coelogenys paca guanta*, *Dinomys branickii occidentalis*, *Dicotyles pecari aequatoris*, *Lonchoglossa wiedi aequatoris*, *Nasua nasua söderströmii*, *N. henseli*, and *N. h. cinerascens*.)

MATTHEW, W. D. The Cannonball Lance formation. Science, n. s., vol. 54, pp. 27–29. July 8, 1921.

——— Notes on the scientific museums of Europe. Nat. Hist., vol. 21, pp. 185–190. March–April, 1921.

MCATEE, W. L. The selection of family names in zoology. Journ. Washington Acad. Sci., vol. 11, pp. 230–235. May 19, 1921. (Argues for family names based on the oldest available generic name.)

MILLER, GERRIT S., JR., AND N. HOLLISTER. Twenty new mammals collected by H. C. Raven in Celebes. Proc. Biol. Soc. Washington, vol. 34, pp. 93–104. June 30, 1921. (New genera and species: *Melasmothrix naso* and

Eropeplus canus. New species and subspecies of *Lenomys*, *Rattus*, *Sciurus*, *Harpyionycteris*, *Pteropus*, *Cheiromeles*, *Crocidura*, and *Tarsius*.)

MITCHELL, P. CHALMERS. Official guide to the gardens of the Zoological Society of London. Nineteenth edition. 112 pp., 52 illust. 1921.

NELSON, EDWARD W. Lower California and its natural resources. Mem. Nat. Acad. Sci., vol. 16, no. 1, pp. 1–194; 34 plates and folding map. 1921. (Contains many references to mammals; maps and definitions of life zones.)

OSBORN, HENRY FAIRFIELD. First appearance of the true mastodon in America. Amer. Mus. Novit., no. 10, pp. 1–6; figs. 1–2. June 15, 1921. (Describes *Mastodon matthewi*, Sioux County, Nebraska; and *M. merriami*, Humboldt County, Nevada.)

——— The first appearance of the true mastodon in America. Science, n. s., vol. 54, p. 108. August 5, 1921.

PIRES DE LIMA, J. A. Anatomy of a fetus of a cyclopean goat. Anat. Rec., vol. 19, pp. 73–81, 6 figs. July 20, 1920.

ROTHSCHILD, LORD. On two new races of *Oryx*. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 209–210. August, 1921. (Describes *Oryx gazella blainei* from Angola, and *O. g. subcallotis* from southern British East Africa.)

RUTLEDGE, ARCHIBALD. Plantation game trails. 300 pp., 12 pls. The Riverside Press, Cambridge, Mass. February, 1921. (Largely devoted to accounts of hunting the white-tailed deer near the mouth of the Santee River, South Carolina. Contains notes on habits of the deer, otter, and fox squirrel.)

SCOTT, H. H., AND CLIVE E. LORD. Nototheria and allied animals,—a rejoinder. Papers of the Royal Soc. Tasmania, pp. 5, pls. 3, issued separately, May 14, 1921.

SHIRAS, GEORGE, 3RD. The wild life of Lake Superior, past and present. Nat. Geog. Mag. vol. 40, no. 2, pp. 114–204; 76 illustrations. August, 1921. (Includes notes on habits of deer, moose, wolves, beavers, and muskrats.)

SIPERSTEIN, DAVID M. The effects of acute and chronic inanition upon the development and structure of the testis in the albino rat. Anat. Rec., vol. 20, pp. 355–391, 14 figs. March 20, 1921.

SOUCHON, EDMOND. A new permanent solution for the preservation of anatomic preparations, the Souchon solution of calcium chloride. Anat. Rec., vol. 18, no. 4, p. 361. May 20 (June), 1920.

STANDLEY, PAUL C. Albinism in the black bear. Science, n. s., vol. 54, p. 74. July 22, 1921.

TAYLOR, WALTER P. Thomomys douglasii shawi, a new subspecies of pocket gopher from Mount Rainier, Washington. Proc. Biol. Soc. Washington, vol. 34, pp. 121–122. June 30, 1921.

THOMAS, OLDFIELD. Three new species of Marmosa, with a note on *Didelphys waterhousei*, Tomes. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 519–523. June, 1921. (New: *Marmosa bruchi*, San Luis, Argentina; *M. verax*, Mision, Paraguay; and *M. mimetra*, Santo Domingo, Ecuador.)

——— The tuco-tuco of San Juan, Argentina. Ann and Mag. Nat. Hist., ser. 9, vol. 7, pp. 523–524. June, 1921. (*Ctenomys coludo johannis*, subsp. nov.)

——— The Arctonyx of Annam. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, p. 524. June, 1921. (Describes *Arctonyx annæus* from Nha-trang, Annam.)

THOMAS, OLDFIELD. Choiropotamus versus Koiropotamus. Proc. Biol. Soc. Washington, vol. 34, p. 135. June 30, 1921. (Maintains that *Choiropotamus* is the tenable name of the river hogs.)

——— The geographical races of *Herpestes brachyurus*, Gray. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 134–136. July, 1921. (New: *Herpestes brachyurus sumatrius*, Sumatra; *H. b. rajah*, lowlands of Sarawak, Borneo; *H. b. dyacorum*, mountains of Sarawak, Borneo.)

——— A new genus of opossum from southern Patagonia. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 136–139. July, 1921. (New genus and species: *Notodelphys halli*, from Cape Tres Puntas, Patagonia.)

——— A new bat of the genus *Promops* from Peru. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, p. 139. July, 1921. (Describes *Promops davisoni* from Department of Lima, Peru.)

——— On spiny rats of the *Proechimys* group from south-eastern Brazil. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 140–143. July, 1921. (New subgenus: *Trinomys*; new subspecies: *Proechimys albispinis sertonius*, Bahia, Brazil.)

——— The "huron" of the Argentine. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 212–213. August, 1921. (New: *Grisonella huronax* from Mar del Plata, Argentina.)

——— On mammals from the province of San Juan, western Argentina. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 214–221. August, 1921. (Describes new forms of *Grisonella*, *Abrocoma*, *Octomys*, *Ctenomys*, and *Lagidium*.)

——— Two new Argentine forms of skunk. Ann. and Mag. Nat. Hist., ser. 9, vol. 8, pp. 221–222. August, 1921. (New: *Conepatus suffocans pampanus* and *C. s. mendosus*.)

INDEX TO VOLUME 2

[New names in **bold-face** type]

A

Ahrens, T. G., Muskrats in central Europe, 236; The present status of the European bison or wisent, 58.
Alces americanus, 69.
gigas, 28.
Allen, A. A., Banding bats, 53.
Allen, G. M., Fossil cetaceans from the Florida phosphate beds, 144; review of Miller's translation of Winge's Review of the interrelationships of the Cetacea, 240.
Alopex innuitus, 21.
Anderson, R. M., John Macoun, 1832–1920, 32.
antelope, American, 116.
prong-horn, 116.
Anthony, A. W., The California gray whale on the coast of southern California, 174; The elephant seal off Santa Cruz Island, California, 112.
Aschemeier, C. R., On the gorilla and the chimpanzee, 90.

B

badger, 71, 170.
Bailey, V., Capturing small mammals for study, 63.
bat, hoary, 53.
large brown, 53, 57.
pipistrelle, 53.
red, 36, 53, 74, 167.
Say's, 53, 73.
silvery-haired, 53, 167.
small brown, 53, 56, 73.
bear, Alaska grizzly, 21.
black, 21, 36, 70.
cinnamon, 21.
beaver, 72, 171, 197.
Canada, 26.
Bishop, S. C., Remains of a fossil phocid from Plattsburg, New York, 170.
Bison caucasius, 61.
europaeus, 58.
bison, European, 58.
Blarina brevicauda, 35, 73.
Bos bonasus, 58.
caucasius, 61.
primigenius, 58.
Brown, C. E., Dates of shedding of antlers, 39.
buffalo, 173.
bulldog, 3.

C

Cahn, A. R., The mammals of Itasca County, Minnesota, 68.
Callorhinus alascanus, 235.
Callospermophilus **certus, 232.**
lateralis, 232.
Canis latrans, 70.
nubilus, 70.
occidentalis, 21.
caribou, Stone, 28.
woodland, 74.
Castor canadensis, 26.
michiganensis, 72.
cat, domestic, 70.
wild, 70.
Cavia cobaya, 130.
Cebus cirrifera, 40.
nigritus, 40.
Cervus axis, 39.
canadensis, 39, 74.
elaphus, 39.
hanglu, 39.
chimpanzee, 90.
chipmunk, 64, 113.
gray, 72.

chipmunk, Lake Superior, 72.
Nevada golden-mantled, 232.
Citellus osgoodi, 25.
tridecemlineatus, 72.
Conepatus mearnsi, 112.
Corner, G. W., A review of some recent work on the mammalian reproductive cycle, 227.
Cystophora cristata, 170.

D

Daphænus hartshornianus, 3.
Dasyprocta felicia, 39.
paraguayensis, 39.
Dasypus hybridus, 39.
deer, axis, 39.
barasingha, 39.
black-tailed, 39.
Columbian black-tailed, 140.
European red, 39.
hog, 39.
Japanese, 39.
Kashmir, 39.
mule, 116, 140, 172.
Virginia, 39, 69.
white-tailed, 116, 172.
Diaphorocetus mediatlanticus, 154.
Dice, L. R., Erroneous ideas concerning skunks, 38; Notes on the mammals of interior Alaska, 20.
Dipodomys, 94.
Dixon, J., notice of his "Control of the coyote in California," 176; notice of his "Notes on the natural history of the bushy-tailed wood rats of California," 42.
Doflein, F., notice of his "Die Fortpflanzung, die Schwangerschaft und das Gebären der Säugetiere," 243.
Dolichorhinus hyognathus, 1, 3.
Dunn, L. C., Unit character variation in rodents, 125.

E

editorial comment, 50.
elk, 116, 172.
American, 39, 74.
Eptesicus fuscus, 53, 57.
Erethizon dorsatum, 72, 130, 238.
myops, 25.
Erinaceus europæus, 110.
Eumetopias stelleri, 16.
Eutamias neglectus, 72.
Evermann, B. W., The Año Nuevo Steller sea lion rookery, 16.
Evotomys dawsoni, 23.

F

Felis catus, 70.
Fiber spatulatus, 24.
zibethicus, 130, 236.
fisher, 74.
Fitzsimons, F. W., notice of his "Natural history of South Africa. Mammals," 41.
fox, 234.
Alaska red, 21.
arctic, 21.
red, 70.

G

Glaucomys sabrinus, 72.
yukonensis, 26.
Goldman, E. A., Two new rodents from Oregon and Nevada, 232.
gopher, 72.
gorilla, 90.
Gregory, W. K., notice of his "Review of the evolution of the lacrymal bone of vertebrates," 118.
Grinnell, G. B., Shed horns of the American antelope, 116; The tree-climbing wolverine, 36.
Grinnell, J., Revised list of the species in the genus Dipodomys, 94.
grizzly, Alaska, 21.
guinea-pig, 130.
Gulo luscus, 22.

H

Haagner, A. K., Red bat at sea, 36.
hare, Macfarlane snowshoe, 27.
Minnesota varying, 71.
varying, 40.
hedgehog, European, 110.

Henninger, W. F., Two mammals new for Ohio, 239.
Herpestes griseus, 234.
Hobson, E. C., The curiosity of the prowling mink, 168.
Hollister, N., editorial comment, 50; review of Fitzsimon's Natural history of South Africa, vols. 3 and 4, 41; review of Gregory's Evolution of the lacrymal bone of vertebrates, 118; review of Osgood's Monographic study of the American marsupial, Cænolestes, 241; review of Pohle's Die Unterfamilie der Lutrinae, 177.
Howell, A. B., Census of private mammal collections, 49; Description of a new species of Phenacomys from Oregon, 98; Field suggestions, 117; The black bear as a destroyer of game, 36.
Hyelaphus porcinus, 39.

J

Jackson, H. H. T., A hybrid deer of the F_2 generation, 140; A mongoose in Kentucky, 234; An inquisitive porcupine, 238; A recent migration of the gray squirrel in Wisconsin, 113; review of King's Comparative study of the birth mortality in the albino rat and in man, 242; The status of Merriam's shrew (Sorex merriami), 29; The third annual meeting of the American Society of Mammalogists, 184; Two unrecognized shrews from California, 161.
Jewett, S. G., Pribilof fur seal on the Oregon coast, 235.
Johnson, C. E., A note on the habits of the timber wolf, 11; Beaver "forms," 171; The "hand-stand" habit of the spotted skunk, 87.
Johnston, T. B., notice of his "The Ileo-caecal region of Callicebus personatus, with some observations on the morphology of the mammalian caecum," 242.
Jones, F. W., On the habits of Trichosurus vulpecula, 187.

K

Kellogg, R., A new pinniped from the upper Pliocene of California, 212.
King, H. D., notice of her "A comparative study of the birth mortality in the albino rat and in man," 242.
Kirk, G. L., Opossum in Vermont, 109; Shrews and weasels, 111.
Klugh, A. B., Notes on the habits of Blarina brevicauda, 35.
Kuroda, N., On three new mammals from Japan, 208.

L

Lama guanicoe, 39.
Lasionycteris noctivagans, 53, 167.
Lasiurus borealis, 167.
lemming, Yukon, 23.
lemming-vole, Dall, 23.
Lemmus yukonensis, 23.
Lepus alleni, 114.
macfarlani, 27.
phæonotus, 71.
Loring, J. A., Notes on the European hedgehog, 110.
Lutra canadensis, 23, 71.
lynx, Canada, 23, 40, 69.
Lynx canadensis, 23, 69.
rufus, 70.

M

Mailliard, J., A handy collecting case, 174.
Manteoceras manteoceras, 3.
Marmota canadensis, 72.
monax, 130.
marten, 74.
Alaska, 21.
Martes actuosa, 21.
americana, 74.
pennanti, 74.
Matschie, P., notice of his "Neue Ergebnisse der Schimpansenforschung," 119.
Mephitis hudsonica, 38, 71.
putida, 87.
Merriam, C. H., Former range of

mountain sheep in northern California, 239.
microsorex, Alaska, 21.
Microsorex eximius, 21.
Microtus drummondi, 24.
endœcus, 24.
ochrogaster, 239.
operarius, 24.
pennsylvanicus, 73, 130.
xanthognathus, 24.
Miller, G. S., notice of his translation of Winge's "A review of the interrelationships of the Cetacea," 240.
Miller, L., The coat color of moles, 163.
mink, 71, 168.
Alaska, 22.
sea, 168.
Mirounga angustirostris, 112.
mole, southern California, 164.
mongoose, 234.
moose, 69.
Alaska, 28.
mouse, deer, 73, 130.
house, 73, 129, 237.
jumping, 73.
meadow, 73.
Mus musculus, 73, 129, 237.
muskrat, 73, 236.
northwestern, 24.
Mustela arctica, 22.
cicognanii, 71, 239.
ingens, 22.
letifera, 71.
longicauda, 37.
macrodon, 168.
namiyei, 209.
rixosa, 71, 209.
washingtoni, 167.
Myotis lucifugus, 53, 56, 73.
subulatus, 53, 73.
Mystax ursulus, 40.

N

Napæozapus insignis, 238.
Neosorex palustris, 73.
Neotoma desertorum, 80.
stephensi, 80.
Nomai, J., notice of his "Das Stimmorgan der Primaten," 243.
Nycteris borealis, 36, 53, 74.
cinerea, 53.

O

Odocoileus borealis, 69.
columbianus, 39, 140.
hemionus, 140.
virginianus, 39.
Ondatra zibethica, 73.
opossum, 109.
Australian, 188.
orang-utan, 194.
Oryctolagus cuniculus, 130.
Osborn, H. F., Resemblances and contrasts between zoologic and palæontologic research in mammalogy, 1.
Osgood, W. H., Notes on nomenclature of South American mammals, 39; notice of his "A monographic study of the American marsupial, Cænolestes," 241.
otter, Canada, 23, 71.
Ovis dalli, 28.

P

Palæosyops major, 1, 3.
Perodipus microps, 233.
preblei, 233.
Peromyscus crinitus, 82.
gambeli, 80.
gracilis, 73.
noveboracensis, 130.
rubidus, 77.
sonoriensis, 80.
stephensi, 82.
phalanger, 188.
Phenacomys longicaudus, 98.
silvicolus, 98.
Pipistrellus subflavus, 53.
Pliopedia pacifica, 213.
Pohle, H., notice of his "Die Unterfamilie der Lutrinae," 177.
Pomatodelphis, 148.
inæqualis, 148.
stenorhynchos, 153.

porcupine, 72, 238.
Alaska, 25.
Pray, L. L., Opossum carries leaves with its tail, 109.
Procyon lotor, 70.
pronghorn, 172.
Pteropus **daitoensis, 210.**

R

rabbit, snowshoe, 101.
raccoon, 70.
Rangifer stonei, 28.
sylvestris, 74.
rat, Norway, 24, 73.
Preble's kangaroo, 233.
Rattus norvegicus, 24, 73, 129.
recent literature, 41, 118, 176, 240.
Rhachianectes glaucus, 124.
Riley, S., Some observations on beaver culture with reference to the national forests, 197.
Rowley, J., Elephant seals off the coast of California, 235.
Rucervus duvaucelii, 39.

S

Saunders, W. E., Notes on Napæozapus, 237.
Scapanus occultus, 164.
Schizodelphis **depressus, 145.**
Schultz, A. H., review of Doflein's Die Fortpflanzung, die Schwangerschaft und das Gebären der Säugetiere, 243; review of Eggeling's Inwieweit ist der Wurmfortsatz am menschlichen Blinddarm ein rudimentäres Gebilde?", 119; review of Johnston's The Ileo-caecal region of Callicebus personatus, etc., 242; review of Matschie's Neue Ergebnisse der Schimpansenforschung, 119; review of Nomai's Das Stimmorgan der Primaten, 243; The occurrence of a sternal gland in orang-utan, 194.
Sciuropterus **orii, 208.**
russicus, 208.
volans, 171.
Sciurus **boliviensis, 39.**
hudsonicus, 25, 72, 130.
inconstans, 40.
leucogaster, 39.
leucotis, 113, 130.
picatus, 92.
vancouverensis, 92.
versicolor, 40.
seal, elephant, 235.
Prbilof fur, 235.
sea-lion, California, 16.
Steller, 16.
Seton, E. T., Gray squirrels and nuts, 238; The sea mink, Mustela macrodon (Prentiss), 168; Wild life and the motor car, 240.
Shaw, W. T., The nest of the Washington weasel (Mustela washingtoni), 167.
sheep, Dall, 28.
mountain, 234, 239.
Sheldon, C., A fox associating with mountain sheep on the Kenai Peninsula, Alaska, 234.
shrew, arctic, 20.
common, 73.
marsh, 73.
Merriam's, 29.
mountain, 20.
Richardson's, 73.
San Bernardino dusky, 161.
short-tailed, 35, 73, 111.
Sonoma, 162.
tundra, 20.
Shufeldt, R. W., Subscriptions received toward the publication of "The comparative osteology of the Procyonidæ," 49.
Sika nippon, 39.
Skinner, M. P., Dates of shedding of horns in Yellowstone Park, 116; Horn shedding in Yellowstone Park, 172.
skunk, 38, 71.
hog-nosed, 112.
spotted, 87.
Snyder, L. L., An outside nest of a flying squirrel, 171.

Soper, J. D., Curious palatal obstruction in Mustela longicauda, 37; Malformed hind foot of the common house mouse, 237; Notes on the snowshoe rabbit, 101.
Sorex arcticus, 20.
leucogenys, 29.
merriami, 29.
obscurus, 20.
parvidens, 161.
personatus, 29, 30, 73.
richardsonii, 29, 30, 73.
sonomæ, 162.
tundrensis, 20.
Spilogale interrupta, 87.
squirrel, flying, 64, 72, 171.
gray, 113, 238.
Kupreanof red, 92.
northern red, 25.
red, 72, 92.
Yukon flying, 26.
Yukon ground, 25.
St. John, H., A tree-climbing woodchuck, 207.
Storer, T. S., The northern California section of the American Society of Mammalogists, 123.
Sumner, F. B., Desert and lava-dwelling mice, and the problem of protective coloration in mammals, 75.
Swarth, H. S., The red squirrel of the Sitkan District, Alaska, 92.
Synaptomys dalli, 23.

T

Tamias griseus, 72.
lysteri, 130.
Taxidea taxus, 71, 170.
Tayassu pecari, 39.
Taylor, W. P., review of Dixon's Control of the coyote in California, 176; review of Dixon's Notes on the natural history of the bushy-tailed wood rats of California, 42; Save the redwoods of California, 183.
Thomas, O., Bats on migration, 167; Separate copies, 182.
titanothere, 1, 3.
Trichosurus vulpecula, 187.
Twitchell, A. H., Notes on the mammals of the lower Yukon region, 40.

U

ur, 58.
Ursus alascensis, 21.
americanus, 21, 36, 70.

V

vole, chestnut-cheeked, 24.
Dawson red-backed, 23.
Drummond, 24.
interior, 24.
tundra, 24.
Vorhies, C. T., Cæsarian operation on Lepus alleni, and notes on the young, 114.
Vulpes alascensis, 21.
fulva, 70.

W

Warren, E. R., A "silk buffalo" robe, 173; The hog-nosed skunk (Conepatus) in Colorado, 112.
weasel, Arctic, 22.
Bonaparte, 111.
least, 71.
short-tailed, 71.
Washington, 167.
whale, California gray, 124.
Winge, H., notice of his "A review of the interrelationships of the Cetacea," 240.
wisent, 58.
wolf, 21.
brush, 70.
timber, 11, 70.
wolf-hound, Russian, 3.
wolverine, 22, 36, 234.
Wood, N. A., A wolverine in a tree, 234; The badger as a swimmer, 170.
woodchuck, 72, 207.

Z

Zalophus californianus, 16.
Zapus hudsonius, 73.

C37